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At a Meeting of the Council of the R. *S*ociety.

Ordered,

THat the Diſcourſe preſented to the *R.Society*, Entitul'd, *The Anatomy of* Vegetables *begun, with a General Accompt of* Vegetables *thereon*, By *N. Grew*, M.D. be Printed by *Spencer Hickman*, one of the Printers of the *R.Society*.

Brouncker Preſ.

THE ANATOMY OF VEGETABLES Begun.

With a GENERAL ACCOUNT OF *VEGETATION* Founded thereon.

By *NEHEMIAH GREW*, M. D. and Fellow of the *Royal Society*.

LONDON,
Printed for *Spencer Hickman*, Printer to the *R. Society*, at the *Rose* in S. *Pauls* Church-Yard, 1672.

TO THE

Right Honourable

&

Most Illustrious

THE

PRESIDENT & FELLOWS

OF THE

ROYAL SOCIETY,

The Following

DISCOURSE

Is most Humbly

Presented

By

The Authour

NEHEMIAH GREW.

TO THE

Right Reverend

JOHN

Lord Bishop of

CHESTER.

MY LORD,

I hope your pardon, if while you are holding *that Best of Books* in one Hand, I here present some Pages of

that of *Nature* into your other: Eſpecially ſince *your Lordſhip* knoweth very well, how excellent a *Commentary* This is on the *Former*; by which, in part God reads the World his own Definition, and their Duty to him.

But if this Addreſs, *my Lord*, may be thought congruous, 'tis yet more juſt; and that I ſhould let *your Lordſhip*, and others know, how much, and how

how deſervedly I reſent your extraordinary Favours: Particularly that you were pleaſed ſo far to animate my Endeavours towards the publiſhing the following *Obſervations*. Many whereof, and moſt belonging to the Firſt Chapter, having now lain dormant near ſeven years; and yet might perhaps have ſo continued, had not *your Lordſhips* Eye at length created

created Light upon them. In doing which, you have given one, amongſt thoſe many Tokens, of as well your readineſs to promote learning and knowledge by the hands of others; as your high Abilities to do it by your own: Both which are ſo manifeſt in *your Lordſhip*, that like the firſt Principles of *Mathematical Science*, they are not ſo much to be aſſerted, becauſe known

and

and granted by all.

The Conſideration whereof, *my Lord*, may make me not only *juſt* in owning of your Favours, but alſo moſt *Ambitious* of your *Patronage*: which yet to beſpeak, I muſt confeſs I cannot well. Not that I think what is good and valuable, is alwaies its own beſt Advocate; for I know that the Cenſures of men are humorous and variable, and that one

Age

Age muſt have leave to frown on thoſe Books, which another will do nothing leſs than kiſs and embrace. But chiefly for this Reaſon, leſt I ſhould ſo much as ſeem deſirous of *your Lordſhips* Solliciting my Cauſe as to all I have ſaid: For as it is your Glory, that you like not ſo to ſhine, as to put out the leaſt Star; ſo were it to your Diſhonour to borrow your

Name

Name to illuſtrate the Spots, though of the moſt conſpicuous.

Your Lordſhips

Moſt Obliged

&

Moſt Humble

Servant

Nehemiah Grew.

THE PREFACE.

OF what antiquity the Anatomy of Animals is, and how great have been its Improvements of later years, is well known. That of Vegetables is a Subject which from all Ages to this day hath not only lain by uncultivated; but for ought I know, except some Observations of some of our own Countrey-men, hath not been so much

as

as thought upon; whether for that the World hath been more enamoured with the former, or pity to humane frailty hath more obliged to it, or other Reasons, I need not enquire.

But considering that both came at first out of the same Hand, and are therefore the Contrivances of the same Wisdom; I thence fully assured my self, that it could not be a vain Design, though possibly unsuccessful, to seek it in both.

In the prosecution hereof, how far I have gone, I neither judge my self, nor leave it to any one else to do it; because no man knows how far we have yet to go, or are capable of going. Nor is there any thing which starves and stinteth the growth of knowledge more, than such Determinations, whether we speak or conceit them only.

What we have performed thus far, lieth, for the most part, open to the use

use and improvement of all men. Only in some places, and chiefly in the Third Chapter, we have taken in the help of Glasses; wherein, after we had finished the whole Composure, some Observations made by that Ingenious and Learned Person Mr. Hook, *a Worthy Member of the* Royal Society, *my much Honoured Friend, and by him communicated to me, were super-added: As likewise some others also* Microscopical, *of my own, which his gave me the occasion of making.*

Those that shall think fit to examine, as well as to peruse these Observations, we advertise them, First, *That they begin, and so proceed till they end again, with the Seed: For they will hardly be able to avoid Errour and Misapprehension, if either partial or preposterous in their Enquiries.* Next, *That they censure*

 not

not their Enqniries to one time of the Year; but to make them in ſeveral Seaſons, wherein the Parts of a Vegetable *may be ſeen in their ſeveral Eſtates.* And then, *That they neglect not the comparative* Anatomy; *for as ſome things are better ſeen in one eſtate, ſo in one* Vegetable, *than another.*

What, upon Obſervation already made, we have erected, as they are not Sticks and Straws; ſo neither do we aſſure all to be of the beſt Oak. How Dogmatical ſoever my Aſſertions may ſeem to be, yet do I not affect the unreaſonable Tyranny of obtruding upon the Faith of any. He that ſpeaketh Reaſon, may be rather ſatisfied, in being underſtood, than believed.

THE

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Cl.

Cl. Glissonius in Prolegomenis præfixis Libro de *Hepatis Anatomia*, c. 1.

Plantæ quoque in hunc censum (*sc. Anatomicum*) veniunt. Varia enim partium textura, & differentiis constant: & proculdubio ex accurata earundem dissectione, utiles valde Observationes nobis exurgerent; præstaretq; in illis (inferioris licet ordinis) rebus examinandis operam impendere,

re, quam in tranſcribendis (ut ſæpe fit) aliorum laboribus, inutiliter ætatem tranſigere. Quippe, hoc pacto, ignavarum apum more, aliena duntaxat alvearia expilamus, nihilq; bono publico adjicimus.

To be added and corrected.

PAg. 8. *l.* 15. after *must*, *adde* upon the Sprouting of the *Bean*. *p.* 12. *l.* 23. after *dense*, *adde* and thence their different Tinctures. *p.* 18. *l*, 13. after *that*, *adde* when. *p.* 20. *l.* 8. for *the*, *read* an. *p.* 56, *l.* 8. *r.* once. *p.* 90. *l.* 11. *dele* as. *p.* 91. *l.* 12. *r.* older. *p.* 120. *l.* 11. after *all*, *r.* is. *p.* 134. *l.* 11. *r. Convolvulus.* *p.* 143. *l.* 10. *r.* ever. *p.* 145. *l.* 14. for *not*, *r.* or. *p.* 159. *l.* 8. for *by*, *r.* to. *p.* 160. *l.* 18. dele *not*. *p.* 185. *l.* 14. after *therewith*, *r.* the. *dele* the former *the*.

In some Copies.

P. 168. *l.* 4. *r. ultimate end*, and *p.* 170. *l.* 22. *r. Favous*.

The Reader is desired to excuse the misplacing of the Figures by the Graver, in the Authors absence.

THE ANATOMY OF VEGETABLES Begun.

With a General Account of *Vegetation* founded thereon.

CHAP. I.

Of the Seed as Vegetating.

BEing to ſpeak of Vegetables; and, as far as Inſpection and conſequent Reaſon may conduct, to enquire into the viſible Conſtitutions and Uſes of their ſeveral

Parts; I chuſe that Method which may with beſt advantage ſuit to what we have to ſay hereon: And that is the Method of Nature her ſelf, in her continued Series of Vegetations, proceeding from the Seed ſown, to the formation of the Root, Trunk, Branch, Leaf, Flower, Fruit, and laſt of all, of the Seed alſo to be ſown again; all which we ſhall in the ſame order particularly ſpeak of.

The Eſſential Conſtitutions of the ſaid Parts are in all Vegetables the ſame: But for Obſervation, ſome are more convenient; in which I ſhall chiefly inſtance. And firſt of all, for the Seed we chuſe the great Garden-Bean.

If we take a Bean then and diſſect it, we ſhall find it cloathed with a double Veſt or Coat: Theſe Coats, while the Bean is yet green, are ſeparable, and eaſily diſtinguiſhed. When 'tis dry, they

they cleave ſo cloſely together, that the Eye, not before inſtructed, will judge them but one; the inner Coat likewiſe (which is of the moſt rare contexture) ſo far ſhrinking up, as to ſeem only the roughneſs of the outer, ſomewhat reſembling Wafers under *Maquaroons*.

At the thicker end of the Bean, in the outer Coat, a very ſmall *Foramen* preſents it ſelf: In diſſection 'tis found to terminate againſt the point of that part which I call the *Radicle*, whereof I ſhall preſently ſpeak. It is of that capacity as to admit a ſmall Virginal Wyer, and is moſt conſpicuous in a green Bean.

This *Foramen* may be obſerved not only in the great Garden-Bean, but likewiſe in the other kinds; in the French-Bean very plainly; in Peaſe, Lupines, Vetches, Lentiles, and other Pulſe 'tis alſo found: and

in many Seeds not reckoned of this kindred, as in that of *Fœnugreek*, *Medica Tornata*, *Goats-Rue*, and others: In many of which, 'tis so very small, as scarcely, without the help of Glasses to be discovered; and in some, not without cutting off part of the Seed besides, which otherwise would intercept the sight hereof; it being in these and such like Seeds, from the place of the breaking off of the Peduncle perfectly distinct.

We may then observe, that all Seeds which have thick or hard Coats, have the same likewise perforated, in this, or some other manner. And accordingly, although the Coats of such Seeds as are lodg'd in Shells or Stones, being thin, are not visibly perforated; yet the Stones and Shells themselves always are; as *Chap.* 7. shall be seen how. To which Chapter, what is farther observable, either as

as to the nature, or number of the covers of the Seed, I alſo refer.

The Coats of the Bean being ſtripp'd off, the proper Seed ſhews it ſelf. The parts whereof it is conſtituted, are three; *ſc.* the main Body, and two other appendant to it, which we may call the three Organical parts of the Bean.

The main Body is not one entire piece, but alwaies divided lengthwiſe into two halves or Lobes, which are both joyn'd together at the Baſis of the Bean. Theſe Lobes in dry Beans, are but difficultly ſeparated or obſerv'd; but in young ones, eſpecially boil'd, they eaſily ſlip aſunder. See *Fig.* 1.

Some very few Seeds are divided, not into two Lobes, but more; as that of *Creſſes*; and ſome not at all divided, but entire; as *Corn*: Excepting which few, all other Seeds, even the ſmalleſt are divided, like as the Bean, into

juſt two Lobes: whereof, though in moſt Seeds we cannot by diſſection be inform'd; yet otherwiſe we eaſily may as ſhall be ſeen.

At the Baſis of the Bean, the two other Organical parts ſtand appendent; by mediation whereof the two Lobes meet and join together. The greater of theſe two parts ſtands without the two Lobes, and upon diveſting the Bean of its Coats, is immediately viſible. 'Tis of a whiter colour, and more gloſſie than the main Body, eſpecially when the Bean is young. In the Bean, and many other Seeds, 'tis ſituated ſomewhat above the thicker end, as you hold the Bean in its moſt proper poſture for growth. In Oak-Kernels, which we call Acorns, Apple-Kernels, Almonds, and many other Seeds, it ſtands prominent juſt from the end; the Baſis and the end being in

in these the same, but in the Bean divers. See *Fig.* 1.

This part is not only in the Bean, and the Seeds above mentioned; but in all others: being that which upon the Vegetation of the Seed, becomes the Root of the Plant; which therefore I call the *Radicle*: by which, I mean the Materials, abating the Formality, of a Root. 'Tis not easie to be observed, saving in some few Seeds, amongst which, that of the Bean is the most fair and ample of all I have seen; but that of some other Seeds, is, in proportion, greater; as of *Fœnugreek*, which is almost as big as one of its Lobes.

The lesser of the two said Appendents lies occult between the two Lobes of the Bean, by separation whereof only it is to be seen. 'Tis enclos'd in two small Cavities form'd in the Lobes for its reception. Its colour comes near that of

the *Radicle*; and is founded upon the Basis thereof, having a quite contrary production, *sc.* towards the cone of the Bean; and being that very part, which, in process, becomes the Body or Trunk of the Vegetable. See *Fig.* 1.

For the sake of this Part principally it is, that the Bean is divided into Lobes; *sc.* that it may be warmly and safely lodged up between them; and so secur'd from the Injuries so tender a Part would sustain from the Mould, whereto, had the Main Body been entire, it must have lain contiguous.

upon ye sprouting of ye Bean

This Part is not, like the *Radicle*, an entire Body, but divided at its loose end into divers pieces, all very close set together, as Feathers in a Bunch; for which reason it may be called the *Plume*. They are so close, that only two or three of the outmost are at first seen: but upon a nice and curious separation

ſeparation of theſe, the more interiour ſtill may be diſcovered. Now as the *Plume* is that Part which becomes the Trunk of the Plant, ſo theſe pieces are ſo many true, and already formed, though not diſplayed, Leaves, intended for the ſaid Trunk, and foulded up in the ſame plicature, wherein, upon the ſprouting of the Bean, they afterwards appear. In a French Bean the two outmoſt are very fair and elegant. In the great Garden-Bean, two extraordinary ſmall Plumes, often, if not always, ſtand one on either ſide the great one now deſcrib'd: From which, in that they differ in nothing ſave in their ſize, I therefore only here juſt take notice of them. And theſe three Parts, *ſc.* the *Main Body*, the *Radicle*, and the *Plume*, are concurrent to the making up of every Seed; and no more than theſe.

Having thus taken a view of the Orga-

Organical Parts of the Bean, let us next examine the Similary, *&c.* thoſe whereof the Organical are compos'd: a diſtinct obſervation of which, for a clear underſtanding of the Vegetation of the Seed, and of the whole Plant ariſing thence, is requiſite: To obtain which, we muſt proceed in our Anatomy.

Diſſecting a Bean then, the firſt Part occurring is its Cuticle. The Eye and firſt Thoughts ſuggeſt it to be only a more denſe and gloſſy Superficies; but better enquiry diſcovers it a real Cuticle. 'Tis ſo exquiſitely thin, and for the moſt part ſo firmly continuous with the Body of the Bean, that it cannot, except in ſome ſmall Rag, be diſtinctly ſeen; which, by carrying your Knife ſuperficially into the Bean, and then very gently bearing upward what you have cut, will ſeparate and ſhew it ſelf transparent.

parent. This Cuticle is not only ſpread upon the Convex of the Lobes, but alſo on their Flats, where they are contiguous, extending it ſelf likewiſe upon both the *Radicle* and *Plume*, and ſo over the whole Bean.

This Part, though it be ſo far common with the Coats of the Bean, as to be like thoſe, an Integument; yet are we in a quite different Notion to conceive of it: For whereas the Coats upon ſetting the Bean, do only adminiſter the Sap, and, as being ſuperſeded from their Office, then die; as ſhall be ſeen: this, on the contrary, with the Organical Parts of the Bean, is nouriſhed, augmented, and by a real Vegetation co-extended.

Next to the Cuticle, we come to the *Parenchyma* it ſelf; the Part throughout which *the inner Body*, whereof we ſhall ſpeak anon, is diſſeminated; for which reaſon

I call it the *Parenchyma*. The Surface hereof is ſomewhat denſe, but inwardly 'tis more porous, and of a laxer Contexture. If you view it in a Microſcope, it hath ſome ſimilitude to the Pith, while ſappy, in the Roots and Trunks of Plants; and that for good reaſon, as in *Ch.* 2. ſhall be ſeen, This is beſt ſeen in green Beans. See *Fig.* 2.

This Part would ſeem by its colour to be peculiar to the Lobes of the Bean; but as is the Cuticle, ſo is this alſo, common both to the *Radicle* and *Plume*; that is, the *Parenchyma* of the Bean, as to its eſſential ſubſtance, is the ſame in all three. The reaſon why the colour of the *Plume*, and eſpecially of the *Radicle*, which is white, is ſo different from that of the Lobes, may chiefly depend upon their being more compact and denſe. And therefore the Lobes themſelves, which are green while the Bean is young;

and thence their different tinctures.

young; yet being old and dry, become whitiſh too. And in many other Seeds, as Acorns, Almonds, the Kernels of Apples, Plums, Nuts, *&c.* the Lobes, even freſh and young, are pure white as the Radicle it ſelf.

But although the *Parenchyma* be common, as is ſaid, to all the Organical Parts; yet in very differing proportions. In the *Plume*, where it is proportionably leaſt, it maketh about three Fifths of the whole *Plume*; in the *Radicle*, it maketh about five Seavenths of the whole *Radicle*; and in each Lobe, is ſo far over-proportionate, as to make at leaſt nine Tenths of the whole Lobe.

By what hath been ſaid, that the *Parenchyma* is not the only conſtituting Part, beſides the Cuticle, is imply'd: there being anothet Body, of an eſſentially different ſubſtance, emboſom'd herein: which

which may be found, not only in the *Radicle* and *Plume*, but alſo in the Lobes themſelves, and ſo in the whole Bean. See *Fig.* 2.

This inner Body appears moſt plain and conſpicuous in cutting the *Radicle* athwart, and ſo proceeding by degrees towards the *Plume*, through both which it runneth in a large and ſtraight Trunk. In the Lobes, being it is there in ſo very ſmall proportion, 'tis difficultly ſeen, eſpecially towards their Verges: yet if with a ſharp Knife you ſmoothly cut the Lobes of the Bean athwart, divers ſmall Specks, of a different colour from that of the *Parenchyma*, ſtanding therein all along in a Line, may be obſerv'd; which Specks are the Terminations of the Branches of this inner Body. See *Fig.* 3.

For this inner Body, as it is exiſtent in every Organical part of the Bean; ſo is it, with reſpect to each part,

part, moſt regularly diſtributed. In a good part of the *Radicle* 'tis one entire Trunk; towards the Baſis thereof, 'tis divided into three main Branches; the middlemoſt runneth directly into the Plume; the other two on either ſide it, after a little ſpace, paſs into the Lobes; where the ſaid Branches dividing themſelves into other ſmaller; and thoſe into more, and ſmaller again, are terminated towards the Verges of each Lobe; in which manner the ſaid inner Body being diſtributed, it becomes in each Lobe, a true and perfect Root. See *Fig.* 2.

This Seminal Root, as now we'll call it, being ſo tender, cannot be perfectly excarnated, as may the Veſſels in the Parts of an Animal, by the moſt accurate Hand; yet by diſſection begun and continu'd, as is above-declared, its whole frame and diſtribution may be eaſi-

ly

ly obſerv'd. Again, if you take the Lobe of a Bean, and lengthwiſe pare off its *Parenchyma* by degrees, and in very thin Shives, many Branches of the Seminal Root, (which by the other way of Diſſection were only noted by ſo many Specks) both as they are fewer about the Baſis of the Bean, and more numerous towards its Verges, in ſome good diſtinction and entireneſs will appear. For this you muſt have new Beans.

As the inner Body is branched out in the Lobes, ſo is it in the *Plume*: For if you cut the *Plume* athwart, and from the Baſis proceed along the Body thereof, you'l find therein, firſt, one large Trunk or Branch, and after four or five very ſmall Specks round about it, which are the terminations of ſo many leſſer Branches therewith diſtributed to the ſeveral parts of the *Plume*. See *Fig.* 4. The diſtribution

ſtribution of the inner Body, as it is continuous throughout all the Organical Parts of the Bean, is repreſented by *Fig.* 2.

This *Inner Body* is, by diſſection, beſt obſervable in the Bean and great Lupine. In other larger Pulſe it ſhews likewiſe ſome obſcure Marks of it-ſelf: But in no other Seeds, which I have obſerved, though of the greateſt ſize, as of *Apples*, *Plums*, *Nuts*, &c. is there any clear appearance hereof, upon diſſection, ſaving in the *Radicle* and *Plume*; the reaſon of which is partly from its quantity, being in moſt Seeds ſo extraordinary little; partly from its Colour, which in moſt Seeds, is the ſame with that of the *Parenchyma* it ſelf, and ſo not diſtinguiſhable from it.

Yet in a *Gourd-Seed*, the whole *Seminal Root*, not only its *Main Branches*, but alſo the Sub-diviſi-

ons and Inosculations of the lesser ones, are without any dissection, upon the separation of the Lobes, on their contiguous Flats immediatly apparent. See *Fig* 5. And as to the existence of this Seminal Root, what Dissection cannot attain, ocular inspection in hundreds of other Seeds, even the smallest, will demonstrate; as in this *Chapter* shall be seen how.

In the mean time, let us only take notice, that when we say every Plant hath its Root, we reckon short; for every Plant hath really two, though not contemporary, yet successive Roots; its Original or *Seminal-Root* within its Seed, and its *Plant-Root*, which the *Radicle* becometh in its growth: the *Parenchyma* of the Seed being in some resemblance, that to the *Seminal Root* at first, which the Mould is to the *Plant-Root* afterwards; and the *Seminal Root* being

ing that to the *Plant-Root*, which the *Plant-Root* is to the *Trunk*. For our better underſtanding whereof, having taken a view of the ſeveral Parts of a Bean, as far as Diſſection conducts; we will next briefly enquire into the uſe of the ſaid Parts, and in what manner they are the Fountain of Vegetation, and concurrent to the being of the future Plant.

The general Cauſe of the growth of a *Bean* or other Seed, is *Fermentation*; that is, the *Bean* lying in the Mould, and a moderate acceſs of ſome moiſture, partly diſſimilar, and partly congenerous, being made, a gentle *Fermentation* thence ariſeth; by which the *Bean* ſwelling, and the *Sap* ſtill encreaſing, and the *Bean* continuing ſtill to ſwell, the work thus proceeds: as is the uſual way of explicating. But that there is imply a *Fermentation*; and ſo a

ſufficient ſupply of *Sap*, is not enough; but that this *Fermentation* and the *Sap* wherein 'tis made, ſhould be under a various Government by divers Parts thereto ſubſervient, is alſo requiſite; and as the various preparation of the *Aliment* in ~~the~~ as *Animal*, equally neceſſary; the particular proceſs of the Work according whereto, we find none undertaking to declare.

Let us look upon a *Bean* then, as a piece of Work ſo fram'd and ſet together, as to declare a Deſign for the production of a Plant, which, upon its lying in ſome convenient Soyl, is thus effected. Firſt of all, the *Bean* being enfoulded round in its Coats, the *Sap* wherewith it is fed, muſt of neceſſity paſs through theſe: By which means, it is not only in a proportionate quantity, and by due degrees; but alſo in

in a purer body; and possibly not without some Vegetable Tincture, transmitted to the *Bean*. Whereas, were the *Bean* naked, the *Sap* must needs be, as over-copious, so but crude and immature, as not being filtred through so fine a Cotton as the Coats be. And as they have the use of a *Filtre* to the transient *Sap*; so of a Vessel to that which is still deposited within them; being alike accommodated to the securer *Fermentation* hereof, as Bottles or Barrels are to Beer, or any other *Fermentative Liquor*.

And as the *Fermentation* is promoted by some Aperture in the Vessel; so have we the *Foramen* in the upper Coat also contrived; that if there should be need of some more aiery Particles to excite the *Fermentation*, through this they may obtain their Entry: Or, on the contrary, should there

be any ſuch Particles or Steams as might damp the genuine proceeding thereof, through this again they may have eaſie iſſue: being that, as a common Paſport here to the *Sap*, which what we call the Bung-hole of the Barrel, is to the new-tunn'd Liquor. That this *Foramen* is truly permeable even in old ſetting *Beans*, appears upon their being ſoak'd for ſome time in Water: For then taking them out, and cruſhing them a little, many ſmall Bubbles will alternately ariſe and break upon it.

The *Sap* being paſſed through the Coats, it next enters the Body of the *Bean*; yet not indiſcriminately neither; but, being filtred through the *Outer Coat*, and fermented both in the Body and Concave of the *Inner*, is by mediation of the *Cuticle*, again more finely filtr'd, and ſo entereth the

Pa-

Parenchyma it ſelf under a fourth Government.

Through which Part the *Sap* paſſing towards the *Seminal Root*, as through that which is of a more ſpatious content; beſides the benefit it hath of a farther percolation, it will alſo find room enough for a more free and active fermenting and maturation herein. And being moreover, part of the true Body of the *Bean*, and ſo with its proper Seminalities or Tinctures copiouſly repleat; the *Sap* will not only find room, but alſo matter enough, by whoſe Energy its *Fermentation* will ſtill be more advanced.

And the *Sap* being duly prepared here, it next paſſeth into all the Branches of the *Seminal Root*, and ſo under a fifth Government. Wherein how delicate 'tis now become, we may conceive by the proportion betwixt the *Parenchy-*

ma and this *Seminal Root*; so much only of the best digested *Sap* being discharged from the whole Stock in that, as this will receive. And this, moreover, as the *Parenchyma*, with its proper Seminalities being endowed; the *Sap*, for the supply of the *Radicle*, and of the young Root from thence, is duly prepared therein, and with its highest Tincture and Impregnation at last enriched.

The *Sap* being thus prepared in the Lobes of the *Bean*, 'tis thence discharg'd; and either into the *Plume* or the *Radicle*, must forthwith issue. And since the *Plume* is a dependent on the *Radicle*; the *Sap* therefore ought first to be dispenced to this; which accordingly is ever found to shoot forth before the *Plume*, and that sometimes an inch or two in length. Now because the primitive course of the *Sap* into the

Radicle,

Radicle, is thus requiſite, therefore by the frame of the Parts of the *Bean* is it made neceſſary too. For we may obſerve that the two main Branches of the *Seminal Root* in which the ſeveral *Ramifications* in either Lobe are all united, commit not themſelves into the *Seminal Trunk* of the *Plume*, nor yet ſo as to ſtand at right Angles with them, and with equal reſpect towards them both; but being producted through part of the *Parenchyma* of the *Radicle*, are at laſt united therein to the main Trunk, and make acute Angles therewith; as may be ſeen by *Fig.* 2. Now the *Sap* being brought as far as the *Seminal Root* in either Lobe, and according to the conduct thereof continuing ſtill to move, it muſt needs immediately iſſue into the ſame part whereinto the main Branches themſelves do, that is, into the *Radicle*. By which *Sap*, thus

thus bringing the ſeveral Tinctures of the parts aforeſaid with it, being now fed; it is no longer a meer *Radicle*, but is made alſo *Seminal*, and ſo becomes a perfect Root.

The *Radicle* being thus impregnate and ſhot into a Root, 'tis now time for the *Plume* to rouze out of its Cloyſters, and germinate too: In order whereto, 'tis now fed from the Root with laudable and ſufficient Aliment. For as the Supplies and motion of the *Sap* were firſt made from the Lobes towards the Root, ſo the Root being well ſhot into the Moulds, and now receiving a new and more copious *Sap* from theſe; the motion hereof muſt needs be ſtronger, and by degrees revert the primitive *Sap*, and ſo move in a contrary courſe, *ſc.* from the *Root* towards the *Plume*; and, by the continuation of the *Seminal Trunk*,

Trunk, is directly conducted thereinto; by which, being fed, it gradually enlarges and displayes it self.

The course of the *Sap* thus turned, it issues, I say, in a direct Line from the *Root* into the *Plume*, but collaterally into the Lobes also; *sc.* by those two aforesaid Branches which are obliquely transmitted from the *Radicle* into either Lobe. By which Branches the said *Sap* being disbursed back into all the *Seminal Root*, and from thence likewise into the *Parenchyma* of the Lobes; they are both thus fed, and for some time augmenting themselves, really grow; as in *Lupines* is evident.

Yet is not this common to all Seeds; some rot under-ground, as *Corn*; being of a laxer and less Oleous substance, differing herein from most other Seeds; and being not divided into Lobes, but one entire

entire thick Body. And ſome, although they continue firm, yet riſe not as the great *Garden-Bean*; in which therefore it is obſervable, that the two Main Branches of the Lobes in compariſon with that which ruus into the *Plume*, are but mean, and ſo inſufficient to the feeding and vegetation of the Lobes; the *Plume*, on the contrary, growing ſo luſty, as to mount up without them.

Excepting a few of theſe two kinds, all other Seeds whatſoever, (which I have obſerved) beſides that they continue firm, upon the Vegetation of the *Plume*, mount alſo upwards, and advance above the Mould together with it; as all Seeds which ſpring up with diſſimilar Leaves; the two (for the moſt part two) diſſimilar Leaves, being the very Lobes of the Seed divided, expanded, and thus advanced.

The Impediments of our apprehenſion

hension hereof are the Colour, Size and Shape of the dissimilar Leaves. Notwithstanding, that they are nothing else but the main body of the Seed, how I came first to phansie, and afterwards to know it, was thus: First, I observed in general that the dissimilar Leaves were never jagg'd, but even edg'd: And seeing the even verges of the Lobes of the Seed hereto respondent, I was apt to think, that those which were so like, might prove the same. Next descending to particular Seeds, I observed first of the *Lupine*; that as to its Colour, upon its advance above the Mould, it ever changed into a perfect Green. And why might not the same by parity of Reason be inferr'd of other Seeds? That, as to its size, it grew but little bigger than when first set. Whence, as I discern'd (the Augmentation being

but

but little) we here had only the two Lobes: So, (as ſome augmentation there was) I inferr'd the like might be, and that, in farther degrees, in other Seeds.

Next, of the *Cucumber*-Seed, That, as to its Colour, often appearing above ground in its Primitive white, from white it turns to yellow, and from yellow to green, the proper colour of a Leaf: That, as to its ſize, though at its firſt ariſe, the Lobes were little bigger than upon ſetting; yet afterwards as they chang'd their Colour, ſo their Dimenſions alſo, growing to a three-four-five-fold amplitude above their primitive ſize: But whereas the Lobes of the Seed are in proportion, narrow, ſhort and thick, how then come the diſſimilar Leaves to be ſo exceeding broad, or long and thin? The Queſtion anſwers it ſelf: For the diſſimilar Leaves, for

that

very reaſon are ſo thin, becauſe ſo very broad or long; as we ſee many things, how much they are extended in length or breadth, ſo much they loſe in depth, or grow more thin; which is that which here befalls the now effoliated Lobes. For being once diſimpriſoned from their Coats, and the courſe of the Sap into them now more and more encreaſed, they muſt needs very conſiderably amplifie themſelves; and from the manner wherein the *Seminal Root* is branched in them, that amplification cannot be in thickneſs, but in length or breadth: In both which, in ſome diſſimilar Leaves 'tis very remarkable; eſpecially in length, as in thoſe of *Lettice*, *Thorn-Apple*, and others; whoſe Seeds, although very ſmall, yet the Lobes of thoſe Seeds growing up into Diſſimilar Leaves, are extended an Inch, and ſometimes more,

more, in length; though he that ſhall attempt to get a clear ſight of the Lobes of *Thorn-Apple*, and ſome others, by Diſſection, will find it no eaſie Task; yet is that which may be obtained. From all which, and the obſervation of other Seeds, I at laſt found, that the diſſimilar Leaves of a young Plant, are nothing elſe but the Lobes or *main Body* of its Seed: So that as the Lobes did at firſt feed and impregnate the *Radicle* into a *perfect Root*; ſo the *Root* being perfected, doth again feed, and by degrees amplifie each Lobe into a perfect Leaf.

The Original of the diſſimilar Leaves thus known, we underſtand, why ſome Plants have none; becauſe the Seed either riſeth not, as *Garden-Beans*, *Corn*, &c. Or upon riſing, the Lobes are little alter'd, as *Lupines*, *Peaſe*, &c. Why, though the proper

Leaves

Leaves are often indented round; the diſſimilar, like the Lobes, are even-edg'd. Why, though the proper Leaves are often hairy, yet theſe are ever ſmooth. Why ſome have more diſſimilar Leaves than two, as *Creſſes*, which have ſix, as the Ingenious Mr. *Sharrock* alſo obſerves; the reaſon whereof is, becauſe the *Main Body* is not divided into two, but ſix, diſtinct Lobes, as I have often counted. Why *Radiſhes* ſeem at firſt to have four, which yet after appear plainly two; becauſe the Lobes of the Seed have both a little Indenture, and are both plaited, one over the other. To which we might add,

The uſe of the diſſimilar Leaves is, firſt, for the protection of the *Plume*; which being but young, and ſo but ſoft and tender, is provided with theſe, as a double Guard, one on either ſide of it.

For this reaſon it is, that the *Plume* in Corn is truſſed up within a membranous Sheath; and that of a *Bean*, cooped up betwixt a pai of *Surfoyls*; but where the Lobe riſe; there the *Plume* hath neithe of them, being both needleſs.

Again, that ſince the *Plume*, be ing yet tender, may be injur'd no only by the Air, but alſo for wan of Sap, the ſupplies from the Roo being yet but ſlow and ſparing that the ſaid *Plume* therefore, b the diſſimilar Leaves, may hav the advantage likewiſe of ſom refreſhment from Dew or Rai For theſe having their Baſis a li tle beneath that of the *Plum* and expanding themſelves on a ſides of it, they often ſtand aft Rain, like a Veſſel of Water, co tinually ſoaking and ſupplin it, leſt its new acceſs into the Ay ſhould ſhrivel it.

Moreover, that ſince the diſſ mil

milar Leaves by their Basis intercept the *Root* and *Plume*, the greater and grosser part of the Sap may be by the way deposited into those; and so the purest proceed into the yet but young and delicate *Plume*, as its fittest Aliment.

Lastly, we have here a demonstration of the being of the *Seminal Root*; which since through the colour or smalness of the Seed, it could not by dissection be observ'd, except in some few; Nature hath here provided us a way of viewing it in the now effoliated Lobes, not of one or two Seeds, but of hundreds; the *Seminal Root* visibly branching it self towards the Cone and Verges of the said Lobes, or now dissimilar Leaves.

CHAP. II.

Of the Root.

HAving examin'd and purſu'd the Degrees of *Vegetation* in the *Seed*, we find its two Lobes have here their utmoſt period; and, that having conveyed their Seminalities into the *Radicle* and into the *Plume*; theſe therefore as the Root and Trunk of the Plant ſtill ſurvive: Of theſe in their order we next proceed to ſpeak; and firſt, of the *Root*: whereof, as well as of the *Seed*, we muſt by Diſſection inform our ſelves.

In Diſſection of a *Root* then, we ſhall

ſhall find it with the *Radicle*, as the Parts of an old man with thoſe of a *Fœtus*, ſubſtantially one. The firſt Part occurring is its Skin, the Original whereof is from the Seed: For that extream thin Cuticle which is ſpred over the Lobes of the Seed, and from thence over the *Radicle*, upon the ſhooting of the *Radicle* into a Root, is co-extended, and becomes its Skin.

The next Part is the *Cortical Body*; the Original whereof likewiſe is from the Seed; or the *Parenchyma*, which is there common both to the Lobes and *Radicle*, being by Vegetation augmented and prolonged into the *Root*, is here the *Cortical Body*, or that which is ſometimes called the *Barque*.

Th e Contexture of this *Cortical Body* may be well illuſtrated by that of a *Sponge*, being a Body Porous, Dilative, and Pliable.

Its Pores, as they are innumerable, ſo extream ſmall. Theſe Pores are not only ſuſceptive of ſo much Moiſture as to fill, but alſo to enlarge themſelves, and ſo to dilate the *Cortical Body* wherein they are; which by the ſhriv'ling in thereof, by being expos'd to the Air, is alſo ſeen. In which dilatation many of its Parts becoming more lax and diſtant, and none of them ſuffering a ſolution of their continuity; 'tis a Body alſo ſufficiently pliable; or, a moſt exquiſitely fine-wrought Sponge.

The Extention of theſe Pores is much alike both by their length and breadth of the Root; which from the ſhrinking up of the *Cortical Body*, in a piece of a cut Root, by the ſame dimenſions, is argu'd.

The proportions of this *Cortical Body* are various: If thin, 'tis called a *Barque*; & thought to ſerve to

to no other end, than what is usually ascrib'd to it as a *Barque*; which is a narrow conceit: If a Bulky Body in comparison with that within it, as in the young Roots of *Cychory*, *Asparagus*, &c. tis here, because the fairest, therefore taken for the prime Part; which, though, as to Medicinal use, it is; yet, as to the private use of the Plant, not so. The Colour hereof, though it be originally white, yet in the continued growth of the Root, divers Tinctures, as yellow in *Dock*, red in *Bistort*, are thereinto introduced.

Next within this Part stands the *Lignous Body*; the Original whereof, as of the two former, is from the Seed; or, the *Seminal Roots* of both the Lobes, being united in the *Radicle*, and with its *Parenchyma* co-extended, is here in the Root the *Lignous Body*.

The Contexture hereof is, in many of its parts, much more close than that of the *Cortical*; and their Pores very different: For whereas those of the *Cortical* are infinitely numerous, these of the *Lignous* are in comparison, nothing so. But these, although fewer, yet are they many of them more open, fair, and visible: as in a very thin Slice cut athwart the young Root of a Tree, and held up against the Light, is apparent: Yet not in all equally, in *Coran*-Tree, in *Goosberry*-Tree, *&c.* less; in *Oak*, *Plums*, and especially *Damascens*, more; in *Elder*, *Vines*, &c. more conspicuous. And as they are different in number and size, so also (whereon the numerousness of the Pores of the *Cortical Body* principally depends) in their shape. For whereas those of the *Cortical Body* are extended much alike both by the length and breadth of the

Root;

Root; these of the *Lignous* are only by the length; which, especially in *Vines* and some other *Roots*, is evident. Of these Pores, 'tis also observable, that although in all places of the *Root* they are visible, yet most fair and open about the *Fibrous Extremities* of some *Roots* (and in many *Roots* higher) where there is no Pith. These Pores, as they shew in young *Roots* of Trees, see in *Fig.* 6, & 7.

This *Lignous Body* lieth with all its Parts, so far as they are visible, in a Circle or Ring; yet are there divers extream small Fibres thence shooting, usually mixed with the *Cortical Body*; and by the somewhat different colour of the said *Cortical Body* where they stand, may be noted these Fibres; the *Cortical Body* and *Skin* all together, properly make the *Barque*.

The proportion betwixt this *Lignous Body* and the *Cortical*, is various,

various, as was ſaid; yet in this, conſtant, *ſc.* that in the fibrous, and ſmaller Parts of the *Root*, the *Lignous Body* is not only in compaſs, but in quantity the leſs; running like a ſlender Wyer or Nerve through the other ſurrounding it. They ſtand both together pyramidally, which is moſt common to *Infant-Roots*, but alſo to many other.

The next Part obſervable in the *Root*, is the *Inſertment*. The exiſtence hereof, ſo far as we can yet obſerve, is ſometimes in the *Radicle* of the Seed it ſelf; I cannot ſay alwayes. As to its ſubſtantial nature, we are more certain; that it is the ſame with that of the *Parenchyma* of the *Radicle*; being alwayes at leaſt augmented, and ſo, in part, originated from the *Cortical Body*, and ſo, at ſecond hand, from the ſaid *Parenchyma*: For in diſſecting a *Root*, we find, that

t the *Cortical Body* doth not on-
environ the *Lignous*, but is alſo
dg'd; and in many pieces in-
ted into it; and that the ſaid
erted pieces make not a meer
lenture, but tranſmit and ſhoot
mſelves quite through as far as
Pith; which in a thin Slice cut
wart the *Root*, as ſo many lines
wn from the Circumference to-
rds the Center, ſhew themſelves.
Fig. 6, & 7.

The Pores of the *Inſertment* are
netimes, at leaſt, extended ſome-
at more by the breadth of the
ot, as about the top of the *Root*
Borage may be ſeen; and are
s different from thoſe of the
rtical Body, which are extended
the length and breadth much
ke; and from thoſe of the *Lig-
us*, being only by its length.

The number and ſize of theſe
ſertions are various. In *Haw-
rn*, and ſome others, and eſpe-
cially

cially *Willows*, they are moſt ex tream ſmall; in *Cherries* and *Plum* they are large; and in *Damaſcen* eſpecially, very fairly apparent. I the *Roots* of ſmall *Plants* they ar generally more eaſily diſcovera ble; which may lead to the obſe vation of them in all.

Theſe Inſertions, although the are continuous through both th length and breadth of the *Root* yet not ſo in all Parts, but by th ſeveral ſhootings of the *Lignou Body* are frequently intercepte For of the *Lignous Body* it is (he beſt) obſervable, That its ſever ſhootings, betwixt which the *Co tical* is inſerted, are not througl out the *Root* wholly diſtinct; bu that all along being enarch'd, th *Lignous Body*, both in length an breadth, is thus diſpoſed int Braces or Oſculations. Betwi theſe ſeveral ſhootings of the *Li nous Body* thus oſculated, the *Co*

tic

ical ſhooting, and being alſo oſcu-
ated anſwerably Brace for Brace,
hat which I call the *Inſertment*
s fram'd thereof.

Theſe Oſculations are ſo made,
hat the Pores of the *Lignous Body*,
think, notwithſtanding, ſeldom
un one into another; but, for
he moſt part, ſtill keep diſtinct;
n the ſame manner as ſome of the
Nerves, though they meet, and
or ſome ſpace are aſſociated toge-
her, yet 'tis moſt probable that
one of their Fibres are truly inoſ-
ulated here, but only in the Ple-
ures.

Theſe Oſculations of the *Lig-
ous Body*, and ſo the interception
f the Inſertions of the *Cortical*,
re not to be obſerv'd by the tra-
erſe cut of the *Root*, but by ta-
ing off the *Barque*, or the *Corti-
al Body*. In the Roots of Trees,
hey are generally obſcure; but in
lants, often more diſtinctly appa-
rent;

rent; and especially in a *Turnep*, the appearance whereof, the *Cortical Body* being stripp'd off, is a piece of close-wrought Networ fill'd up with the Insertions of t said *Cortical Body*. See *Fig.* 8.

The next and last distinct P of the *Root* is the *Pith*. The substa tial nature thereof, is, as was sa of the *Insertment*, the same lik wise with that of the *Parenchy* of the Seed. And according the best observation we have made, 'tis sometimes existent in *Radicle*; in which, the two m Branches of the Lobes both me ing, and being osculated togeth are thus dispos'd into one rou Trunk, and so environing part the *Parenchyma*, make thereo *Pith*; as in either the *Radicle*, the young *Root* of the great *B* or *Lupine*, may, I think, be v seen.

But many times the Orig her

hereof is immediately from the *Cortical Body*. For in diſſection of divers *Roots* both of Trees and Plants, as of *Barberry* or *Mallows*, it is obſervable, that the *Cortical Body* and *Pith* are both of them participant of the ſame Colour; in the *Barberry* both of them tinged yellow, and in *Mallows* green. In cutting the ſmaller Parts of the Roots of many Plants, as of *Borage*, *Mallows*, *Parſley*, *Columbine*, &c. 'tis alſo evident, that the *Lignous Body* is not there in the leaſt Concave, but ſtandeth perfectly in the Center; and that the Inſertions being gradually multiplied afterwards, the *Pith* at length, towards the thicker parts of the *Root*, ſhews and enlarges it ſelf. Whence it appears, that in all ſuch *Roots*, the *Pith* is not only of the ſame ſubſtantial nature, and by the Inſertions doth communicate with the *Cortical Body*; and that

it

it is alſo more or leſs augmented by it; which is true of the *Pith* of all *Roots*; but is moreover, by mediation of the ſaid Inſertions wholly originated from it. The various appearances of the *Inſertions* and *Pith* from the Fibrous Parts to the top of the *Root*, ſee in *Fig.* 9, 10, 11, 12, 13, 14. The Pores of the *Lignous Body*, entire in the ſaid Fibrous Parts, are beſt ſeen when they have lain by night dry, after cutting.

A farther evidence hereof are the Proportions betwixt the *Cortical Body* and *Pith*. For as about the inferiour Parts of the *Root* where the *Pith* is ſmall, the *Cortical Body* is proportionably great; ſo about the top, where the *Pith* is enlarged, the *Cortical Body* groweth proportionably leſs, *ſc.* becauſe by its Inſertions, 'tis gradually beſtowed into the *Pith*. Likewiſe the peculiar frame of ſome

Root

Roots, wherein besides the *Pith*, he *Lignous Body* being divided nto a double Ring, there is also a hick Ring, of a white and soft ubstance, stands betwixt them; nd is nothing else but the Insertions of the *Cortical Body* collected nto the said Ring; but, towards he top of the Root, being inserted again, thus maketh a large and mple *Pith*; as in *Fennel*-Roots is een.

The Pores of the *Pith*, as those f the *Cortical Body*, are extended oth by the breadth and length of he *Root*, much alike; yet are they nore or less of a greater size than hose of the *Cortical Body*.

The Proportions of the *Pith*, are arious; in Trees, but small; in lants generally, very fair; in me making by far the greatest art of the *Root*; as in a *Turnep*: y reason of the wide circumfence whereof, and so the finer

Concoction and Assimilation of its Sap; that part which in most old Trunks is a dry and harsh *Pith*, here proves a tender pleasant meat. The parts of a *Turnep* in the travers cut see in *Fig.* 8.

In the Roots of very many Plants, as *Turneps*, *Carrots*, &c the *Lignous Body*, besides its main utmost Ring, hath divers of its osculated Fibres dispersed throughout the Body of the *Pith*; some times all alike, and sometime more especially in, or near, its Center; which Fibres, as they run towards the top of the *Root* still declining the Center, at last collaterally strike into its Circumference; either all of them, or some few, keeping the Center still; of these principally the *Lignous Body* of the Trunk is often originated.

These Fibres, although they are so exceeding slender, yet in some

Root

Roots, as in that of *Flower-de-liz*, they are visibly concave, each of them, in their several Cavities also embosoming a very small *Pith*; the sight whereof, the Root being cut traverse, and laid in a Window for a day or two to dry, may without Glasses be obtain'd. And this is the general account of the *Root*; the declaration of the manner of its growth, with the use and service of its several parts, we shall next endeavour.

We say then, that the *Radicle* being impregnate, and shot into the Moulds, the contiguous moisture, by the *Cortical Body*, being a Body laxe and Spongy, is easily admitted: Yet not all indiscriminately, but that which is more adapt to pass through the surrounding Cuticle. Which transient Sap, though it thus becomes fine, yet is not simple; but a mixture of Particles, both in respect of those

originally in the Root, and amongſt themſelves, ſomewhat heterogeneous. And being lodg'd in the *Cortical Body* moderately laxe, and of a Circular form; the effect will be an eaſie Fermentation. The *Sap* fermenting, a ſeparation of Parts will follow; ſome whereof will be impacted to the Circumference of the *Cortical Body*, whence the Cuticle becomes a Skin; as we ſee in the growing of the Coats of Cheeſes, of the Skin over divers Liquors, and the like. Whereupon the *Sap* paſſing into the *Cortical Body*, through this, as through a *Manica Hippocratis*, is ſtill more finely filtred. With which *Sap*, the *Cortical Body* being dilated as far as its *Tone*, without a ſolution of Continuity will bear; and the ſupply of the *Sap* ſtill renew'd; and the pureſt part, as moſt apt and ready, recedes, with its due Tinctures, from the ſaid

Cortical

Cortical Body, to the *Lignous*. Which *Lignous Body* likewise super-inducing its own proper Tinctures into the said *Sap*; 'tis now to its highest preparation wrought up, and becomes (as they speak of that of an Animal) the Vegetative *Ros* or *Cambium*: the noblest part whereof is at last coagulated in, and assimilated to the like substance with the said *Lignous Body*. The remainder, though not united to it, yet tinctur'd therein, thus retreats, that is, by the continual appulse of the *Sap*, is in part carried off into the *Cortical Body* back again, the *Sap* whereof it now tinctures into good Aliment: So that whereas before the *Cortical Body* was only relaxed in its Parts, and so dilated; 'tis now increas'd in real quantity or number of parts, and so is truly nourish'd. And the *Cortical Body* being saturate with so much of this Vital *Sap* as serves

it ſelf; and the ſecond Remainders diſcharged thence to the Skin; this alſo is nouriſh'd and augmented therewith. So that as in an *Animal Body* there is no inſtauration or growth of Parts made by the Bloud only, but the *Nervous Liquor* is alſo thereunto aſſiſtant; ſo is it here: the *Sap* prepared in the *Cortical Body*, is as the Arterious; and that part thereof prepared by the *Lignous*, is as the *Nervous Liquor*; which partly becoming Nutriment to it ſelf, and partly being diſcharged back into the *Cortical Body*, and diffuſing its Tincture through the *Sap* there, that to the ſaid *Cortical Body* and *Skin*, becomes alſo true Nutriment, and ſo they all now grow.

In which growth, a proportion in length and breadth is requiſite: which being rated by the benefit of the Plant, both for firm ſtanding and ſufficient Sap, muſt therefore

fore principally be in length. And because it is thus requisite, therefore by the constitution of one of its Parts, *sc.* the *Lignous Body*, it is also made necessary. For the Pores hereof, in that they are all extended by its length, the *Sap* also according to the frame and site of the said Pores will principally move; and that way as its *Sap* moves, the same way will the generation of its Parts also proceed; *sc.* by its length. And the *Lignous Body* first (that is, by a priority causal) moving in length it self; the *Cortical* also moves therewith. For that which is nourish'd, is extended; but whatever is extended, is mov'd; that therefore which is nourish'd, is mov'd: The *Lignous Body* then being first nourish'd, 'tis likewise first mov'd, and so becomes and carries in it the Principle of all Vegetative moti-

on in the *Cortical*; and ſo they both move in length.

Yet as the *Lignous Body* is the Principle of Motion in the *Cortical*; ſo the *Cortical* is the Moderator of that in the *Lignous*: As in Animal Motions, the Principle is from the Nerves; yet being once given to the Muſcle or Limb, and that moving proportionably to its ſtructure, the Nerves alſo are carried in the ſame motion with it. We ſuppoſe therefore, that as the principal motion of the *Lignous Body* is in length, ſo is its proper tendency alſo to aſcend: But being much exceeded both in Compaſs and Quantity by the *Cortical* as in the ſmaller parts of the *Root* it is; it muſt needs therefore be over-born and governed by it, and ſo, though not loſe its motion yet make it that way wherein the *Cortical Body* may be more obedient to it; which will be by de

ſcent

cent: Yet both of them being ufficiently pliable, they are thus apable, where the Soyl may opose a direct descent, there to divert any way where it is more petrable, and so to descend obquely. For the same reason it ay also be, that though you set *Bean* with the *Radicle* upward; et the *Radicle*, as it shoots, declining also gradually, is thus arch'd n form of an Hook, and so at last lescends. For every declination rom a perpendicular Line, is a nixed motion betwixt Ascent and Descent; as that of the *Radicle* also is, and so seeming to be dependent upon the two contrary Tendencies of the *Lignous* and *Cortical Bodies*. What may be the cause of those Tendencies (being most probably external, and perhaps something of a *Magnetisme*) is besides my Task here to enquire.

Now although the *Lignous Body*, by

by the position and shape of its Pores, principally groweth in length; yet will it in some degree likewise in breadth: For it cannot be supposed that the purest *Sap* is all received into the said Pores; but that part thereof likewise, staying about its *Superficial parts*, is there tinctur'd and agglutinated to them. And because these Pores are prolonged by its length; therefore is it much more laxe and easily divisible that way; as in slitting a Stick, or cleaving of Timber, and in cutting and hewing them athwart is also seen. Whence it comes to pass, that in shooting from the Center towards the Circumference, and there finding more room, its said original Laxity doth easily in divers places now become greater, aud at length in open Partments plainly visible. Betwixt which Partments, the *cortical Body*, being bound in on the one hand

nd, by the ſurrounding Skin d Moulds, and preſſed upon by e *Lignous* on the other, muſt eds inſert it ſelf, and ſo move ntrary to it, from the Circum- ence towards the Center: where e ſaid contrary motions continu- as begun, they at laſt meet, ite, and either make or augment e *Pith*. And thus the *Root* is m'd, and the Skin, the *cortical* d *Lignous Bodies*, ſo as is ſaid, reunto concurrent. We ſhall xt ſhew the uſe of the two other rts, *ſc.* the *Inſertment* and *Pith*; d firſt of the *Pith*,

One true uſe of the *Pith* is for e better Advancement of the *p*, whereof we ſhall ſpeak in the xt Chapter. The uſe we here ſerve is for the quicker and gher Fermentation of the *Sap*: r although the Fermentation ade in the *Cortical Body* was well ſub-

ſubſervient to the firſt Vegetation
yet thoſe more perfect ones in th
Trunk, which after follow, requi
a Body more adapted to it, an
that is the *Pith*; which is ſo nece
ſary, as not to be only common t
but conſiderably large in the *Roo*
of moſt Plants; if not in their i
feriour parts, yet at their top
Where though either deriv'd
amplify'd from the *Cortical Boa*
yet being by its Inſertions only
we may therefore ſuppoſe, as thoſ
ſo this, to be more finely conſtit
ted. And being alſo from its c
arctation, while inſerted, now fre
all its Pores, upon the ſupply
the *Sap*, will more or leſs be amp
fied: Upon which accounts, t
Sap thereinto received, will
more pure, and its fermentati
therein more active. And as t
Pith is ſuperiour to the *Cortic*
Body by its Conſtitution, ſo by
Place. For as it thus ſtands ce
tra

al, it hath the *Lignous Body* ſur-
ounding it. Now as the Skin is
e Fence of the *Cortical Body*,
nd that of the *Lignous*; ſo is the
ignous again a far more prehemi-
ent one unto the *Pith*; the *Sap*
eing here a brisk Liquor, tunn'd
p as in a wooden Cask.

And as the *Pith* ſubſerves the
gher Fermentation of the *Sap*;
do the Inſertions its purer Diſtri-
ution; that ſeparation which the
rts of the *Sap*, by being ferment-
l in the *Pith*, were diſpos'd for;
ing, upon its entrance into the
ſertions, now made: So that
the Skin is a Filtre to the *Corti-
l Body*, ſo are the Inſertions a
ore preheminent one to the *Li-
ous*; and as they ſubſerve the
rer, ſo the freer and ſufficient di-
ibution of the *Sap*: For the
ot enlarging, and ſo the *Lignous
dy* growing thicker, although
e *Cortical* and the *Pith* might ſup-
ply

ply *Sap* ſufficient to the nutrition of its Parts next adjacent to them; yet thoſe more inward, muſt needs be ſcanted of their *Aliment*; and ſo, if not quite ſtarv'd, yet be uncapable of equal growth: Whereas the *Lignous Body* being through its whole breadth frequently diſparted, and the *Cortical Body* inſerted through it; the *Sap* by thoſe Inſertions, as the Blood by the diſſeminations of the *Arteries*, is freely and ſufficiently convey'd to its intimate Parts, even thoſe which from either the *cortical Body* or the *Pith* are moſt remote. Laſtly, as the conſequent hereof, they are thus aſſiſtant to the Latitudinal growth of the *Root*; as the *Lignous Body* to its growth in length; ſo theſe Inſertions of the *Cortical* to its better growth in breadth.

Having thus ſeen the ſolitary uſes of the Several Parts of the *Root*, we ſhall laſtly propound our

Con

Conjectures of that Design where-
o they are all together concur-
ent, and that is the Circulation of
he *Sap*: For the *Sap* moving through
he *cortical Body*, towards the *Pith*,
hrough the Insertions thereinto,
btains a pass: Which passage,
he superiour Insertions will not
vour; because the *Pith* standing
n the same height with them, is
here large, the fermenting and
ourse of the *Sap* quick, and so its
pposition strong. But through
he inferiour it will much more ea-
ly enter; because there, through
he smalness of the *Pith*, the op-
osition is little, and through the
hortness of the Insertions, the way
ore open. So that though the
ap may meet with some opposition
ven here, yet here meeting with
he least, here it will bestow it
lf (feeding the *Lignous Body* in
s passage) into the *Pith*. Into
hich fresh *Sap* still entring, this,
being

yet but crude, will ſubſide: that firſt receiv'd and ſo become a Liquor higher wrought, will more eaſily mount upwards; and moving in the *Pith*, as in the *Arteria magna*, in equal altitude with the more ſuperiour Inſertions; the moſt volatile parts of all will ſtill continue their direct aſcent towards the *Trunk*. But thoſe of a middle nature, and, as not apt to aſcend, ſo being lighter than thoſe beneath them, not to deſcend neither; they will tend from the *Pith* towards the Inſertions in a motion betwixt both; through which Inſertions (feeding the *Lignous Body* in its paſſage) it is by the next ſubſequent *Sap*, diſcharged off into the *cortical Body* as into the *Vena cava*, back again. Wherein, being ſtill purſu'd by freſh *Sap* from the Center, and more occurring from the Circumference, towards the inferiour Inſertion

ertions it thus deſcends; through vhich, together with part of the *'ap* afreſh imbib'd from the Mould, : re-enters the *Pith*. From whence, nto the *Cortical Body*, and from nence into the *Pith*, the cruder art thereof reciprocally is diſ-urs'd; while the moſt Volatile, ot needing the help of a Circula-on, more directly aſcendeth to-ards the *Trunk*.

F CHAP.

CHAP. III.

Of the Truuk.

HAving thus declar'd the degrees of *Vegetation* in the *Root*; the continuance hereof in the *Trunk* shall next be shew'd: in order to which, the Parts whereof this likewise is compounded we shall first observe.

That which without dissection shews it self, is the *Coarcture*: cannot say of the *Root*, nor of the *Trunk*; but what I chuse here to mention, as standing betwixt them, and so being common to them both; all their Parts being here bound in closer together, a

in

n the tops of the grown Roots of very many Plants, is apparent.

Of the Parts of the *Trunk*, the first occurring is its *Skin*: The Formation whereof, is not from the Air, but in the *Seed*, from whence it is originated; being the production of the Cuticle, there investing the two *Lobes* and *Plume*.

The next Part is the *Cortical Body*; which here in the *Trunk* is no new substantial formation; but, as is that of the *Root*, originated from the *Parenchyma* of the *Seed*; and is only the increase and augmentation thereof. The *Skin*, this *Cortical Body* properly so call'd, and (for the most part) some Fibers of the *Lignous* mixed herewith, all together make the *Barque*.

Next, the *Lignous Body*, which, whether it be visibly divided into many softer Fibres, as in *Fennel*, and most Plants; or that its parts

ſtand more compact and cloſe, ſhewing one hard, firm and ſolid piece, as in Trees; it is in all one and the ſame Body; and that not formed originally in the *Trunk*, but in the *Seed*; being nothing elſe but the prolongation of the *Inner Body* diſtributed in the *Lobes* and *Plume* thereof.

Laſtly, The *Inſertions* and *Pith* are here originated likewiſe from the *Plume*, as the ſame in the *Root* from the *Radicle*: So that as to their ſubſtantial Parts, the *Lobes* of the Seed, the *Radicle* and *Plume*, the *Root* and *Trunk* are all one.

Yet ſome things are more fairly obſervable in the *Trunk*. Firſt, the *Latitudinal* ſhootings of the *Lignous Body*, which in *Trunks* of ſeveral years growth, are viſible in ſo many Rings, as is commonly known: For ſeveral young Fibres of the *Lignous Body*, as in the *Root*, ſo here, ſhooting into the

Cortical

Cortical one year, and the ſpaces betwixt them being after fill'd up with more (I think not till) the next, at length they become altogether a firm compact Ring; the perfection of one Ring, and the ground-work of another being thus made concomitantly.

From theſe Annual younger Fibres it is, that although the *Cortical Body* and *Pith* are both of the ſame ſubſtantial nature, and their Pores little different; yet whereas the *Pith*, which the firſt year is green, and of all the Parts the fulleſt of *Sap*, becomes afterwards white and dry; the *Cortical Body*, on the contrary, ſo long as the Tree grows, ever keepeth green and moiſt, *ſc.* becauſe the ſaid Fibers annually ſhoot into, and ſo communicate with it.

The Pores likewiſe of the *Lignous Body*, many of them in well-grown Timber, as in Oaken boards,

are very conſpicuous, in cutting both lengthwiſe and traverſe; they very ſeldom run one into another, but keep, like ſo many ſeveral Veſſels, all along diſtinct; as by cutting, and ſo following any one of them as far as you pleaſe, for a Foot or half a Yard, or more together, may be obſerv'd.

Theſe greater Pores, though in Wainſcot, Tables, and the like, where they have lain long open, they are but meer Vacuities, and ſo would be thought to contain only *Sap* in the Tree, and afterwards only Air; yet upon a freſh cut, each of them may be ſeen fill'd up with a light and ſpongie Body, which by Glaſſes, and even by the bare eye, appears to be a perfect *Pith*; ſometimes entire, and ſometimes more or leſs broken.

Beſides theſe, there are a leſſer ſort; which, by the help of a *Microſcope*, alſo appear, if not to be fill'd

ll'd up with a *Pith*, yet to contain ertain light and filmy parts, more r fewer, of a *Pithy* nature within nem.

And these are all the Pores the est Glasses, which, (when upon hese Enquiries) we had at hand, vould shew us. But the Learned nd most Ingenious Naturalist Mr. *Hook* sheweth us moreover, besides these, a third, and yet naller sort; the description where-of I find he hath given us amongst his *Microscopical Observations*. Of these Pores (as a confirmation of what, in the Second Chapter, I have said of the Pores of the *Ligneous Body* in general) he also demonstrates; that they are all continuous and prolonged by the length of the *Trunk*, as are the greater ones; the Experiment whereof he imparteth to be, by filling up, suppose in a piece of *Char-coal*, all the said Pores with

Mercury; which appears to paſs quite through them, in that by a very good Glaſs it is viſible in their Orifices at both ends; and without a Glaſs, by the weight of the Coal alone, is alſo manifeſt.

Upon farther Enquiry, I likewiſe find, that the Pores of the *Lignous Body* in the *Trunk* of Plants, which at firſt we only ſuppoſed, by the help of good Glaſſes are very fairly viſible; each Fibre being perforated by 30, 50, 100, or hundreds of Pores. Or what I think is the trueſt notion of them, that each Fibre, though it ſeem to the bare eye to be but one, yet is indeed a great number of Fibres together; every Pore being not meerly a ſpace betwixt the ſeveral pores of the Wood, but the Concave of a Fiber: So that if it be asked, what all that part of a Vegetable, either Plant or Tree, which is properly call'd the woody

part,

rt; what all that is, I ſuppoſe, at is nothing elſe but a Cluſter innumerable and moſt extraor-nary ſmall Veſſels or concave bres. See *Fig.* 15.

Next the Inſertions of the *Cor-cal Body*, which in the *Trunk* of a ree ſaw'd athwart, are plainly ſcerned as they run from the ircumference toward the Cen-r; the whole Body of the Tree eing viſibly compounded of two ſtinct Subſtances, that of the ſe-eral Rings, and that of the Inſer-ons, running croſs; ſhewing that in me reſemblance in a Plain, which e Lines of Latitude and of the eridian do in a Globe. See *ig.* 16.

Theſe Inſertions are likewiſe ve-conſpicuous in Sawing of Trees ngth-wayes into Boards, and oſe plain'd, and wrought into eaves for Tables, Wainſcot, renchers, and the like. In all which,

which, as in course Trenchers made of *Beech*, and Tables of Oak, there are many parts which have a greater smoothness than the rest; and are so many inserted pieces of the *Cortical Body*; which by reason of those of the *Lignous*, seem to be discontinuous, although in the *Trunk* they are extended throughout its Breadth.

These Insertions, although as is said, of a quite distinct substance from the *Lignous Body*, and so no where truly incorporated with it, yet being they are in all parts, the one as the Warp, the other as the Woof, mutually braced and interwoven together, they thus constitute one strong and firmly coherent Body.

As the Pores are greater or less, so are the Insertions also: To the bare eye usually the greater only are discernable: But through an indifferent *Microscope* there are

other

ners alſo, much more both nu-
rous and ſmall, diſtinctly appa-
it. So that, I think, we may ob-
ve, that as the grand *Pith* of the
nk communicates with, and is
gmented by the greater Inſerti-
s; ſo is the *Pith* of each greater
re originated from the leſs; and
oſe (at leaſt) pithy parts in the
dling Pores, from others ſtill
s; and ſuppoſe, that the leaſt
all are ſo far intruded into the
alleſt Pores, as only juſt to cauſe
kind of roughneſs on their con-
ve ſides, and no more; to
hat end ſhall be ſaid See *Fig.* 17.
In none of all theſe Pores can
e obſerve any thing which may
ve the true nature and uſe of
lves, which is eaſily to admit
at, to which they will by no
eans allow a regreſs. And their
on-exiſtence is enough evident,
om what in the firſt Chapter we
ve ſaid of the *Lobes* of the *Seed*:
in

in whoſe *Seminal Root*, were there any *Valves*, it could not be, that by a contrary courſe of the *Sap* they ſhould ever grow; which yet, where-ever they turn into Diſſimilar Leaves, they do. O if we conſider the growth of the *Root*, which oftentimes is upward and downward both at once.

The Inſertions here in the *Trunk* give us likewiſe a ſight of the poſition of their Pores. For in a plained piece of Oak, and in Wainſcot, Tables, *&c.* beſide the larger Pores of the *Lignous Body*, which run by the length of the *Trunk*; the Tract likewiſe of thoſe of the Inſertions may be obſerved to be made by the breadth and ſo directly croſs. Nor are the continuous as thoſe of the *Lignous Body*, but very ſhort, as thoſe both of the *Cortical Body* and *Pith*, with which the Inſertions, as to their ſubſtance are congenerous. Yet

the

ey all ſtand ſo together, as to be ainly ranked in even Lines or ows throughout the breadth of e *Trunk*: As the Tract of theſe ores appear to the naked Eye, ſee *Fig.* 18. By the beſt Microſcope ave at hand, I can only obſerve e Ranks of the Pores; not the ores themſelves, ſaving here and ere one; wherefore I have not ſcrib'd them.

The Pores of the *Pith* likewiſe ing larger here in the *Trunk*, are tter obſervable than in the *Root*: e width whereof, in compariſon th their ſides ſo exquiſitely thin, y by an Honey-Comb be groſly emplified; and is that alſo which e vaſt diſproportion betwixt the lk and weight of a dry *Pith* th enough declare. In the *Trunks* ſome Plants, they are ſo ample d tranſparent, that in cutting th by the length and breadth of e *Pith*, ſome of them, even to the

the bare eye would ſeem to be co
ſiderably extended by the lengt
of the ſaid *Pith*; which once I al
thought they were, and that on
the reſt of them were but ſho
and diſcontinuous, and as 'tis ſai
ſomewhat anſwerable to the Ce
of an Honey-Comb. This w
the neareſt we could come to the
by conjecture, and the aſſiſtan
of the beſt Glaſſes we then had
us, when upon enquiry into t
nature of the *Pith*: But th
Worthy Perſon newly mention
Mr. *Hooke* ſheweth us, that t
Pores of the *Pith*, particularly
Elder-Pith, ſo far as they are viſib
are all alike diſcontinuous; a
that the *Pith* is nothing elſe (
uſe his own words) but an he
of Bubbles.

Beſides what this Obſervati
informs us of here, it farther co
firms what in the ſecond Chap
we have ſaid of the Original of t

P

ith and *Cortical Body*, and of the
ımeneſs of both their natures with
ıe *Parenchyma* of the Seed. For,
pon farther enquiry with better
laſſes, I find, that the *Parenchy-*
a of the *Plume* and *Radicle*, and
ven of the *Lobes* themſelves,
ıough not ſo apparently, is no-
ıing elſe but a Maſs of Bubbles.

In the *Piths* of many Plants, the
eater Pores have ſome of them
ſſer ones within them, and ſome
f them are divided with croſs
embranes: And betwixt their
veral ſides, have, I think, other
ıaller Pores viſibly interjected.
owever, that they are all perme-
ıle, is moſt certain. They ſtand
gether not indeterminately, but
even Ranks or Trains; as thoſe
the Inſertions by the breadth,
theſe by the length of the *Trunk*.
ıd thus far there is a general cor-
ſponding betwixt the part of the
ot and *Trunk*: Yet are there
ſome

ſome conſiderable Diſparities be twixt them; wherein, and hov they come to paſs, and to wha eſpecial uſe and end, ſhall next b ſaid.

We ſay then, that the *Sap* be ing in the *Root* by Filtrations Fermentations (and in what *Root* needful, perhaps by Circulatio alſo) duly prepar'd; the prim part thereof paſſing through th intermediate Coarcture, in du moderation and purity is enter tain'd at laſt into the *Trunk*. An the *Sap* of the *Trunk* being pure and more volatile, and ſo it ſel apt to aſcend; the motion of th *Trunk* likewiſe will be more no ble, receiving a diſpoſition an tendency to aſcend therewith And what by the *Sap* the *Trun* is in part diſpos'd to, by the reſpe ctive poſition and quantity of it Parts it is effectually enabled. Fo whereas in the *Root* the *Lignou*

Bod

ody being in proportion with the *ortical*, but little, and all lying ose within its Center; it must herefore needs be under its con-oul: on the contrary, being here omparatively of greater quantity, nd also more dilated, and having vers of its Branches standing ore abroad towards the Circum-rence, as both in the Leaves and ody of the young *Trunk* and *ume*, is seen; it will in its own ndency to ascend, reduce the *rtical Body* to a compliance with

And the *Trunk* thus standing om under the restraint of the ould in the open Air, the dispo-on of its Parts originally diffe-nt from that of the Parts in the ot will not only be continued, t improved: For by the force l pressure of the *Sap* in its col-eral Motion, the *Lignous Body* l now more freely and farther

be dilated. And this being dila-
ted, the *Cortical Body* alſo, mu-
needs be inſerted; and is there-
fore in proportion alwayes mo-
or leſs ſmaller here in the *Trunk*
than in the *Root*. And as the *Co-*
tical Body leſſens, ſo the *Pith* wi-
be enlarged, and by the ſame pro-
portion is here greater, And th-
Pith being enlarged it ſelf, i-
Pores (the *Lignous Body*, upo-
its dilatation, as it were tenterin-
and ſtretching out all their ſide-
muſt needs likewiſe be enlarge-
with it, and accordingly are ev-
greater in the *Pith* of the *Trunk*
than of the *Root*. And the di-
tation of the *Lignous Body* ſt-
continued, it follows, that whe-
as the *Pith* deſcendent in the *Ro*
is not only in proportion leſs a-
leſs, but alſo in the ſmaller ext-
mities thereof, and ſometimes hig-
er altogether abſent: Contra-
wiſe, in the *Trunk* it is not on-

cc-

ontinued to its top, but alſo here in proportion equally ample ith what it is in any other inferi- ur part.

But although the openneſs of e Ayr permitting be alwayes a- ke; yet the Energy of the *Sap* ffecting, being different; as herefore that doth, the dilatation f the *Trunk* will alſo vary. If hat be leſs, ſo is this; as in the *runks* of moſt Trees: If that be reater, ſo is this; as in Plants is ommon; the *Lignous Body* being ſually ſo far dilated, that the *ut- moſt Shootings* thereof may eaſily e ſeen to jut out, and adjoyn to he Skin. And if the *Sap* be ſtill f greater energy, it ſo far dilates e *Lignous Body*, as not only to mplifie the *Pith* and all its Pores; ut alſo ſo far to ſtretch them out, s to make them tear. Whereup- n either running again into the *ortical Body*, or ſhrinking up to-

wards it, the *Trunk* thus ſometimes becomes an *hollow Stalk*, the *Pith* being wholly, or in part voyded. But generally it keeps entire; and where it doth, the ſame proportion and reſpect to the *Lignous* and *Cortical Bodies*, as is ſaid. The Conſequences of all which will be, the ſtrength of the *Trunk*: the ſecurity and plenty of the *Sap*: its Fermentation will be quicker: its Diſtribution more effectual, and its Advancement more ſufficient.

Firſt, the erect growth and ſtrength of the *Trunk*; this being by the poſition of its ſeveral parts effected: For beſides the ſlendering of the *Trunk* ſtill towards the top, the Circumferential poſition of the *Lignous Body* likewiſe is, and that eminently hereunto ſubſervient: So that as the *Lignous Body* in the ſmaller part of the *Root* ſtanding Central, we may thence

conceiv

conceive and ſee their pliableneſs to any oblique motion; ſo here, on the contrary, the *Ligneus Body* ſtanding wide, it thus becomes the ſtrength of the *Trunk*, and moſt advantageous to its perpendicular growth. We ſee the ſame Deſign in *Bones* and *Feathers*: The ſtrongeſt *Bones*, as thoſe in the Legs, are hollow. Now ſhould we ſuppoſe the ſame *Bone* to be contracted into a Solid Body, although now it would be no heavier, and in that reſpect, as apt for motion; yet would it have far leſs ſtrength, than as it is dilated to a Circumferential poſture. And ſo for *Quills*, which, for the ſame Reaſons, in ſubſerviency to flight, we ſee how exceeding light they are, and yet, in compariſon with the thinneſs of their Body, how very ſtrong: We ſee it not only in Nature, but Art. For hence it is that *Joyners* and *Carpenters*

unite and ſet together their Timber-pieces and ſeveral Works oftentimes with double Joynts; which, although they are no thicker than a ſingle one might be made, yet ſtanding at a diſtance, have a greater ſtrength than that could have. And the ſame Architecture will have the ſame uſe in the *Trunks* of Plants, in moſt whereof 'tis very apparent; as for inſtance, in Corn: For Nature deſigning its *Sap* a great Aſcent for its higher maturity, hath given it a tall *Trunk*; but to prevent its ravenous deſpoiling either of the Ear or Soyl; although it be tall, yet are its ſides but thin: and becauſe again, it ſhould grow not only tall and thriftily, bnt for avoiding propping up, ſtrongly too; therefore, as its height is over-proportioned to the thinneſs of its ſides, ſo is its Circumference alſo; being ſo far dilated as to parallel a *Quill*

it

t ſelf. Beſides the poſition of he *Lignous Body* within the com-ɔaſs of a Ring, we ſee ſome ſhoot-ngs thereof often ſtanding beyond he Circumference of the ſaid Ring, naking ſometimes a triangular, ɔftner a quadrangular Body of the *Trunk*; to the end, that the Ring ɔeing but thin, and not ſelf-ſuffi-ient, theſe, like Splinters to *Bones*, might add ſtrength and tability to it.

Next, the ſecurity and plenty of the *Sap*. For ſhould the *Li-nous Body*, as it doth in the *Root*, ts ſmaller parts, ſtand Central here alſo, and ſo the *Cortical* whol-y ſurround it: the greater part of the *Sap* would thus be more mmediately expos'd to the Sun, and ayr; and being lodg'd in a laxe Body, by them continually be ɔrey'd upon, and as faſt as ſuppli-ed to the *Trunk*, be exhauſted. Whereas the *Pith* ſtanding in the

Center, the *Sap* therein being not only most remote from the Ayr and Sun, but by the *Barque*, and especially the *Wood*, being also surrouuded and doubly immur'd, will very securely and copiously be convey'd to all the Collateral parts, and (as shall be said how) the top of the *Trunk*.

And the *Sap* by the amplitude, and great porosity of the *Pith* being herein more copious, its Fermentation also will be quicker; which we see in all Liquors by standing in a greater quantity together, proceeds more kindly: And being tunn'd up within the *Wood*, is at the same time not only secur'd from loss, but all extream mutations, the Day being thus not too hot, nor the Night too cold for it.

And the Fermentation hereof being quicker, its motion also will be stronger, and its distribution

more

ore effectual, not only to the ilatation of the *Trunk*, but likeiſe the ſhooting out of the Branches. Whence it is, that in the odies of Trees, the *Barque* of it lf, though it be ſappy, and ma-y Fibres of the *Lignous Body* mixl with it, yet ſeldom ſendeth orth any; and that in Plants, hoſe with the leaſt *Pith* (other lvantages not ſupplying this deect) have the feweſt or ſmalleſt ranches, or other collateral rowths: and that *Corn*, which ith no *Pith*, hath neither any ranches.

Laſtly, the Advancement of the *ip* will hence alſo be more reay and ſufficient. For the underanding where, and how, we ſupoſe that in all *Trunks* whatſoever here are two parts joyntly hereto ſubſervient. In ſome the *Lignous Body* and the *Cortical*, as in lder *Trunks*, the *Pith* being either ex-

excluded or dried: But in moſt, principally the *Lignous Body* and *Pith*; as in moſt Annual Growths of Trees; but eſpecially Plants, where the *Cortical Body* is uſually much and often wholly inſerted.

Of the *Lignous* body it is ſo apparent by its Pores, or rather by its Veſſels, that we need no farther evidence. For ~~as~~ to what end are Veſſels but for the conveyance of Liquor? And is that alſo, which upon cutting the young Branch of a Sappy Tree or Plant, by an accurate and ſteady view may be obſerved. But when I ſay the Pores of the *Lignous Body*, I mean principally them of the younger ſhootings, both thoſe which make the new Ring, and thoſe which are mixed with the *Cortical Body* in the *Barque*: that which aſcendeth by the Pores of the older Wood, being probably, becauſe in leſs quan-

antity, more in form of a Va-
ur, than a Liquor. Yet that
ich drenching into the ſides of
Pores, is with all thereunto ſuf-
ent Aliment; as we ſee *Or-*
e, Onions, &c. only ſtanding in
moyſter Ayr will often grow;
d being likewiſe in part ſuppli-
by the Inſertions from the youn-
r Shoots: But eſpecially, be-
uſe as it is but little, ſo it ſerveth
ly for the growth of the ſaid
Wood, and no more; whereas
e more copious Aliment aſcen-
nt by the younger Shoots, ſub-
ves not only their own growth,
t the generation of others; and
beſides with that in the *Cortical*
dy the Fountain of *Perſpirations*,
ich we know even in Animals
much more abundant than the
tritive parts; and doubtleſs in
egetable are ſtill much more.

But theſe Pores, although they
a free and open way to the
aſcend-

ascending *Sap*; yet that mee
Pores or Vessels should be able o
themselves to advance the *Sa*
with that speed, strength & plenty
and to that height, as is necessary
cannot probably be supposed. I
follows then, that herein we mus
grant the *Pith* a joynt service. An
why else in the smaller parts of th
Root, where the *Pith* is often want
ing, are the Pores there greater
Why is the *Pith* in all primitiv
growths the most *Sappy* part, wh
hath it so great a stock of *Sap*,
not after due maturation within
self still to be disbursed into th
Fibres of the *Lignous Body*? Wh
are the annual growths of all bot
Plants and Trees with great Pith
the quickest and the longest? Bu
how are the Pores of the *Pith* pe
meable? That they are so, bot
from their being capable of a re
pletion with *Sap*, and of being a
gain wholly emptied of it, an

again

gain, instead thereof fill'd with
yr, is as certain as that they are
ores. That they are permeable,
the breadth, appears from the
latation of the *Lignous Body*, ~~and~~
nd from the production of Bran-
nes, as hath been, and shall here-
ter be said. And how else is
ere a Communion betwixt this
nd the *Cortical Body*? That they
e so also, by the length, is proba-
e, because by the best *Microscope*
e cannot yet observ, that they are
sibly more open by the breadth,
an by the length. And withal are
nked by the length, as those of
e Insertions by the breadth of the
unk. But if you set a piece of
y *Elder-Pith* in some tinged Li-
or, why then doth it not pene-
ate the Pores, so as to ascend
rough the Body of the *Pith*? The
ain reason is, because they are all
l'd with Ayr. Whereas the *Pith*
a Vegetating Plant, as its Parts

or

or Pores are ſtill generated, they are at the ſame time alſo fill'd with *Sap*; which, as 'tis gradually ſpent, is ſtill repair'd by more ſucceeding, and ſo the Ayr ſtill kept out; as in all primitive growths, and the *Pith* of *Elder* it ſelf: Yet the ſame *Pith*, by reaſon of the following Winter, wanting a more copious and quick ſupply of *Sap*, thus once become, ever after keeps dry. And ſince in the aforeſaid Trial the Liquor only aſcends by the ſides of the *Pith*, that is of its broken Pores, we ſhould thence by the ſame reaſon conclude that they are not penetrable by the breadth neither, and ſo no way; and then it need not be ask'd what would follow. But certainly the *Sap* in the Pores of the *Pith* is diſcharged and repaired every moment, as by its ſhriv'ling up, upon cutting the Plant is evident.

We ſuppoſe then, that as the

Sa

Sap aſcendeth into the *Trunk* by he *Lignous Body*, ſo partly alſo by he *Pith*. For a piece of *Cotton* vith one end immerſ'd in ſome tin-ed Liquor, and with the other e-ect above, though it will not im-ibe the Liquor ſo far as to over-un at the top, yet ſo as to advance owards it, it will; ſo here, the *ith* being a porous and ſpongy ody, and in its Vegetating ſtate its ores alſo permeable, as a curious iltre of Natures own contrivance, thus advanceth, or as people e to ſay, ſucks up the *Sap*. Yet as is ſeen of the Liquor in the Cot-on; ſo likewiſe are we to ſuppoſe of the *Sap* in the *Pith*; that ough it riſeth up for ſome way, et is their ſome term, beyond hich it riſeth not, and towards hich the motion of the aſcending *ap* is more and more broken, weak d ſlow, and ſo the quantity ereof leſs and leſs. But becauſe the

the *Sap*. moveth not only by the length, but breadth of the *Pith*; at the ſame time therefore as it partly aſcendeth by the *Pith*, it is likewiſe in part preſſed into the *Lignous Body* or into its Pores. And ſince the motion of the *Sap* by the breadth of the *Pith* not being far continued, and but collateral, is more prone and eaſie than the perpendicular, or by its length; it therefore follows, that the collateral motion of the *Sap*, at ſuch a height or part of the *Pith*, will be equally ſtrong with the perpendicular at another part, though ſomewhat beneath it; and that where the perpendicular is more broken and weak, the collateral will be leſs; and conſequently where the perpendicular tendency of the *Sap* hath its term, the collateral tendency thereof, and ſo its preſſure into the Pores of the *Lignous Body* will ſtill continue.

Through

Through which, in that they are ſmall, and ſo their ſides almoſt contiguous, the *Sap* as faſt as preſſed into them will eaſily run up; as betwixt the two halves of a Stick firſt ſlit, and then tied ſomewhat looſely together, may alſo any Liquor be obſerved to do. And the ſides of the ſaid Pores being not ſmooth, but by the intruſion of the ſmalleſt inſertions made ſomewhat rough; by that means the higher and more facile aſcent of the *Sap* therein will farther be promoted. By all which Advantages the facility and ſtrength of that aſcent will be continued higher in the ſaid Pores than in the *Pith*. Yet ſince this alſo, as well as that in the *Pith* will have its term; the *Sap*, though got thus far, would yet at laſt be ſtagnant, or at leaſt its ſcent be very ſparing, ſlow and feeble, if not ſome way or other reinforced. Wherefore, as the

Sap moving by the breadth of the *Pith*, preſſeth thence into the Pores of the *Lignous Body*; ſo having well fill'd theſe, is in part by the ſame Collateral motion disburſed back into a yet higher Region of the *Pith*. By which partly, and partly by that portion of the *Sap* which in its perpendicular aſcent was before lodged therein; 'tis thu here, as in any inferiour place e qually repleat. Whereupon th force and vigour of the perpen dicular motion of the *Sap* herein will likewiſe be renew'd; and ſ its Collateral motion alſo, and ſ its preſſure into the Pores of th *Lignous Body*, and conſequentl its aſcent therein; and ſo by preſſure from theſe into the *Pit* and from the *Pith* into theſe rec procally carried on, a moſt read and copious aſcent of the *Sap* wi be continued from the bottom t the top, though of the highe *Trunk*.

An Appendix.

Of Trunk-Rooots and Claſpers.

THe diſtinct Parts whereof there are conſtituted, are the ſame th those of the *Trunk*, and but e continuation of them.

Trunk-Roots are of two kinds: the one, are thoſe that vege-e by a direct deſcent: The ice of their Eruption is ſome-nes all along the *Trunk*; as in *int*, &c. Sometimes only at its most point, as in the *Bram-*.

The other ſort are ſuch as nei-er aſcend nor deſcend, but ſhoot

forth at right Angles with the *Trunk*; which therefore, though as to their Office, they are true *Roots*, yet as to their Nature, they are a *Middle thing* betwixt a *Root* and a *Trunk*.

Claſpers, though they are but of one kind, yet their nature is double; not a mean betwixt that of the *Root* and that of the *Trunk*, but a compound of both; as in their Circumvolutions, wherein they often mutually aſcend and deſcend, is ſeen.

The uſe of theſe Parts may be obſerved as the *Trunk* mounts, or as it trails. In the mounting of the *Trunk*, they are for ſuppor and ſupply: For ſupport, we ſee the *Claſpers* of *Vines*; the Branches whereof being very long, fragile and ſlender, unleſs by the *Claſpers* they were mutually contain'd together, they muſt need by their own weight, and that of

the

heir Fruit, undecently fall, and be alſo liable to frequent breaking. So that the whole care is divided betwixt the Gardener and Nature; he Gardener with his Ligaments of Leather ſecures the main Branches; and Nature with theſe of her own finding, ſecures the leſs. Their Conveniency to which end, is ſeen in their Circumvolutions, a motion not proper to any other Part: As alſo in their toughneſs or ſtrength, though much more tender than the Branches whereon they are appendent.

For Supply, we ſee the *Trunk-Roots* of *Ivy*: For mounting very high, and being of a cloſer Conſtitution than that of a *Vine*, the *Sap* could not be ſufficiently ſupplied to the upper Sprouts, unleſs theſe to the *Mother-Root* were poyntly aſſiſtant. Yet ſerve they for ſupport likewiſe; whence they shoot out, not as in *Creſſes*, *Brook-*

lime, &c. reciprocally on each ſide, but commonly all in one; that ſo they may be faſtened at the neareſt hand.

In the Trailing of the *Trunk*, they ſerve for ſtabiliment, propagation and ſhade. For ſtabiliment, we ſee the *Claſpers* of *Cucumbers*: For the *Trunk* and *Branches* being long and fragile, the Bruſhes of the Winds would injuriouſly hoiſe them to and fro, to the dammage both of themſelves and their tender Fruit, were they not by theſe Ligaments brought to good Aſſociation and Settlement.

As for this end, ſo for Propagation, we ſee the *Trunk-Roots* of *Camomile*. Whence we have the reaſon of the common obſervation, that it grows better by being trod upon: the Mould, where too laxe, being thus made to lie more conveniently about the ſaid *Trunk-Roots* newly bedded therein; and

that which we ſee alſo effected
Rowling of *Corn.*

For both theſe ends, we ſee the
unk-Roots of *Strawberries*; as
ſo for ſhade; for in that we ſee
l *Strawberries* delight; and by
e trailing of the Plant is well
tain'd: So that as we are wont
tangle the Twigs of Trees to-
ther to make an *Arbour Artifici-*
; the ſame is here done to make
Natural one; as likewiſe by the
aſpers of *Cucumbers*: For the
anches of the one by the Link-
g of their *Claſpers*, and of the
her by the Tethering of their
unk-Roots, being couched toge-
ier; their tender fruits thus lie
nder the Umbrage of a *Bower*
ade of their own Leaves.

CHAP. IV.

Of the Germen, Branch, and Leaf.

THe Parts of the *Germen* and *Branch*, are the ſame with thoſe of the *Trunk*; the ſame *Skin*, *Cortical* and *Lignous Bodies*, *Inſertment* and *Pith*, hereinto propagated, and diſtinctly obſervable herein.

For upon Enquiry into the Original of a *Branch* or *Germen*, it appears, That it is not from the *Superficies* of the *Trunk*, but ſo deep as to take with the *Cortical*, the *Lignous Body* into it ſelf; and that not only from its Circumference but

out (ſo as to take the *Pith* in alſo) rom its *Inner* or *Central parts*. Divers whereof may commonly e ſeen to ſhoot out into the *Pith*; rom which *Shoots*, the ſurrounding nd more ſuperiour *Germens* are o-iginated; in like manner as the *Li-nous Body* of the *Trunk* is ſome-imes principally from thoſe Fi-rous *Shoots* which run along the *ith* in the *Root*.

The manner wherein uſually he *Germen* and *Branch* are fram'd, briefly thus: The *Sap* (as is id, *Chap.* 3.) mounting in the *runk*, will not only by its length, ut by its breadth alſo, through he *Inſertions* partly move. Yet, s Particles being not all alike qua-fied, in different degrees: Some e more groſs and ſluggiſh; of hich we have the formation of a ircle of Wood only, or of an nnual Ring: Others are more isk; and by theſe we have the

Germen

Germen propagated. For by the vigour of their own motion from the Center, they impreſs an equal tendency on ſome of the inner parts of the *Lignous Body* next adjacent to the *Pith*, to move with them. And ſince the *Lignous Body* is not entire, but frequently diſparted; through theſe diſpartments, the ſaid interiour Parts, upon their Nutrition, actually ſhoot; not only towards the Circumference, ſo as to make part of a Ring, but even beyond it, in order to the production of a *Germen*. And the *Lignous Body* thus moving, and carrying the *Cortical* along with it; they both make a force upon the *Skin*: Yet their motion being moſt even and gradual, that force is ſuch likewiſe: not to cauſe the leaſt breach of its parts, but gently to carry it on with themſelves; and ſo partly by the extenſion of its already exi-

ſten

tent parts, as of those of Gold in drawing of Guilded Wyer; and partly by the accretion of new ones, as in the enlarging of a Bubble above the Surface of the Water, it is extended with them to their utmost growth. In which growth, the *Germen* being prolonged, and so displaying its several parts, as when a *Prospective* or *Telescope* is drawn out, thus becomes a *Branch*.

The same way as the propagation of the Parts of a *Germen* is conciv'd is its due nutrition also: For being originated from the inner part of the *Lignous Body*, 'tis nourished with the best fermented *Sap* in the *Trunk*, *&c.* that next adjacent to it in the *Pith*. Besides, since all its Parts, upon their shooting forth, divaricate from their perpendicular, to a cross Line, as these and the other grow and arrive together, bind and throng

each

each other into a Knot; through which Knot the *Sap* being ſtrain'd, 'tis thus in due moderation & purity delivered up into the Branch.

And for Knots, they are ſo neceſſary, as to be ſeen not only where collateral Branches put forth; but in ſuch Plants alſo as ſhoot up in one ſingle *Trunk*; as in *Corn*; wherein, as they make for the ſtrength of the *Trunk*; ſo by ſo many percolations as they are Knots, for the tranſmiſſion of the *Sap* more and more refined towards the Ear. So that the two general uſes of Knots are for firmer ſtanding, and finer growth.

Laſtly, as the due Formation and Nutrition of the *Germen* are provided for, ſo is its ſecurity alſo; which both in its poſition upon the *Trunk*, and that of its Parts among themſelves may be obſerved. The poſition of its Parts ſhall be conſidered in ſpeaking of the

Leaf

Leaf. As to its ſtanding in the *trunk*, 'tis alwayes betwixt the *trunk* or *Elder Branch*, and the *Baſis* of the Stalk of the *Leaf*; wherebyy it is not only guarded from the njuries of any contingent Vioence, but alſo from the more pierring aſſaults of the Cold, ſo long till n time 'tis grown, as larger, ſo more hardy. The manner and uſes of he poſition of every *Germen*, conidered as after it becomes a *Branch*, ath already been by the Ingenious Mr. *Sharrock* very well obſerred; to whom I refer.

Upon the prolongation of the *ermen* into a *Branch*, its *Leaves* re thus diſplay'd. The Parts hereof are ſubſtantially the ſame ith thoſe of a *Branch*: For the kin of the Leaf is only the amplition of that of the *Branch*; being artly by the accretion of new, partly the extention of its alreay exiſtent parts (dilated as in making

king of *Leaf-Gold*) into its present breadth. The Fibres or Nerves dispersed through the Leaf, are only the Ramifications of the *Branch*'s Wood, or *Lignous Body*. The *Parenchyma* of the Leaf which lies betwixt the Nerves, and as in Gentlewomens Needle-works, fills all up, is nothing else but the continuations of the *Cortical Body*, or inner part of the *Barque* from the *Branch* into it self, as in most Plants with a fat Leaf, may easily be seen.

The Fibres of the *Leaf* neither shoot out of the *Branch* nor *Trunk*, nor stand in the *Stalk*, in an even Line; but alwayes in either an Angular or Circular posture, and usually making either a Triangle, or a Semi-Circle, or Cord of a Circle; as in *Cycory*, *Endive*, *Cabbage*, &c. may be observed: And if the Leaf have but one main Nerve, that also is posture'd in a Circular or Lunar Figure

ure; as in *Mint* and others. The ıſual number of theſe Nerves or ibres is 3, 5, or 7. See the *Figures* from 20, to 29.

The reaſon of the ſaid Poſitions f the Fibres in the *Stalk* of the *eaf*, is for its more erect growth, nd greater ſtrength; which, were he poſition of the ſaid Fibres in n even Line, and ſo the Stalk it lf, as well as the Leaf flat, muſt eeds have been defective; as from hat we have ſaid of the Circumerential poſture of the *Lignous Body* in the *Trunk*, we may better onceive.

As likewiſe for the ſecurity of s *Sap*: For by this means it is, hat the ſeveral Fibres, and eſpeially the main or middle Fibre of he Leaf, together with a conſideable part of the *Cortical Body*, are o diſpoſed of, as to jut out, not om its upper, but its back, or ether plain. Whence the whole

Leaf,

Leaf, reclining backward, becomes a Canopy to them, defending them from those Injuries which from colder Blasts, or an hotter Sun, they might otherwise sustain. So that by a mutual benefit, as these give suck to all the Leaf, so that again protection to these.

These Fibres are likewise the immediate visible Cause of the shape of the Leaf: For if the nethermost Fibre or Fibres in the Stalk be in proportion greater, the Leaf is long, as in *Endive*, *Cycory* and others: If all of a more equal size, it spreads rounder, as in *Ivy*, *Doves-foot*, *Colts foot*, &c. And although a *Dock-Leaf* be very long, whose Fibres notwithstanding, as they stand higher in the Stalk, are disposed into a Circle all of an equal size; yet herein a peculiar fibre standing in the Center betwixt the rest, and running through the length of the Leaf, may be observed.

In

In correſpondence alſo to the ze and ſhape of theſe Fibres, is ne Leaf flat: In that either they e very ſmall, or if larger, yet ey never make an entire Circle Ring; but either half of one, as *Borage*, or at moſt three parts of ne, as in *Mullen*, may be ſeen. or if either they were ſo big, as contain; or ſo entire, as perctly to include a *Pith*, the Energy the *Sap* in that *Pith*, would uſe the ſaid *Lignous Ring* to ſhoot th on every ſide, as it doth in e *Root* or *Trunk*: But the ſaid bres being not figur'd into an tire Ring, but ſo as to be open; that hand therefore where o-n, they cannot ſhoot any thing ectly from themſelves, becauſe re they have nothing to ſhoot; l the *Sap* having alſo a free vent ough the ſaid opening, againſt t part therefore which is there-o oppoſite, it can have no force;

and ſo neither will they ſhoot forth on that hand; and ſo will they conſequently that way only which the force of the *Sap* directs, which is only on the right and left.

The ſeveral Fibres in the Stalk, are all inoſculated in the Leaf, with very many Sub-diviſions; according as theſe Fibres are inoſculated near, or at, or ſhoot directly to the edge of the Leaf, is it even or ſcallop'd. Where theſe Inoſculations are not made, there we have no *Leaves*, but only a company of *Ramulets*, as in *Fennel*.

The Formations and Foulding of Leaves have one Date, or are the contemporary works of Nature; each Leaf obtaining its diſtinct ſhape, and proper poſture together; both being perfect, not only in the outer, but Central and minuteſt Leaves, which ſometimes are five hundred times ſmaller than the outer; both which in the Ca-

tic

ious opening of a *Germen* may be
een.

Nor is there greater Art in the
orms, than in the Foulds or Po-
tures of *Leaves*; both anſwera-
ly varying, as this or that way
hey may be moſt agreeable. Of
he *Quincuncial* poſture, ſo amply
nſtanc'd in by the Learned Dr.
rown; I ſhall omit to ſpeak. O-
hers there are, which though not
ll ſo univerſal, yet equally neceſ-
ary where they are; giving two
eneral advantages to the Leaves,
legancy and Security, *ſc.* in ta-
ing up, ſo far as their Forms will
ear, the leaſt room; and in being
o conveniently couch'd, as to be
apable of receiving protection
om other parts, or of giving it
o one another; as for inſtance,

Firſt, There is the *Plain-Lap*,
here the Leaves are all laid
omewhat convexly one over ano-
her, but not plaited; being to

the length, breadth and number of Leaves most agreeable; as in the Buds of *Pear-tree*, *Plum-tree*, &c. But where the Leavs are not so thick set, as to stand in the *Plain-lap*, there we have the *Plicature*; as in *Rose-tree*, *Strawberry*, *Cinquefoyl*, *Burnet*, &c. For the Leaves being here plaited, and so lying in half their breadth, and divers of them thus also collaterally set together, the thickness of them all, and half their breadth, are much alike dimensions; by which they stand more secure within themselves, and in better consort with other *Germen-Growths* in the same Truss. If the Leaves be much indented or jagg'd, now we have the Duplicature; where there are divers Plaits in the same Leaf, or Labels of a Leaf, but in distinct Sets, a lesser under a greater; as in *Tansey*, &c. When the Leaves stand not collaterally, but single,

and

and that they are moreover very broad; then we have the *Multiplicature*; as in *Gooſeberries*, *Mallows*, &c. the Plaits being not only divers in the ſame Leaf, but of the ſame ſet continuant, and ſo each Leaf gather'd up in five, ſeven, or more Foulds, in the ſame manner as our Gentlewomens Fans: Where either the thickneſs of the Leaf will not permit a *flat lap*, or the fewneſs of their number, or the ſmallneſs of their Fibres, will allow the *Rowl*, there this may be obſerved; which is ſometimes ſingle, as in *Bears-Ears*; ſometimes double, the two *Rowls* beginning at each edge of the Leaf, and meeting in the middle. Which again, is either the *Fore-Rowl*, or the *Back-Rowl*. If the Leaf be deſign'd to grow long, now we have the *Back-Rowl*, as in *Docks*, *Primroſes*, &c. For the main Fibres, and there with a conſiderable

part of the *Cortical Body* ſtanding prominent from the *Back-plain* of the Leaf, they thus ſtand ſecurely couch'd up betwixt the two *Rowls*; on whoſe ſecurity the growth of the Leaf in length depends. But *Bears-Ears*, *Violets*, &c. upon contrary reſpects, are rowled up inwards. Laſtly, there is the *Tre-Rowl*, as in *Fern*; the *Labels* whereof, though all rowled up to the *main Stem*, yet could not ſtand ſo firm and ſecure from the Injuries either of the Ground or Weather, unleſs to the *Rowls* in breadth, that by the length were ſuper-induc'd; the *Stalk* or *main Stem* giving the ſame protection here, which in other Plants by the Leaves, or ſome particular *Mantling*, is contriv'd.

For according to the Form and Foulding of every Leaf or *Germen*, is its protection order'd; about ſix wayes whereof may be obſerv'd: *ſc.* by *Leaves*, *Surfoyles*, *Interfoyles*, *Stalks*,

Stalks, *Hoods* and *Mantlings*. To add to what we have above given, one or two Instances. Every Bud, besides its proper Leaves, is covered with divers Leafy *Pannicles* or *Surfoyls*; which, what the Leaves are to one another, are that to them all: For not opening except gradually, they admit not the Weather, Wet, Sun or Ayr, to approach the Leaves, except by degrees respondent, and as they are leisurely inur'd to bear them. Sometimes, besides *Surfoyls*, there are also many *Interfoyls* set betwixt the Leaves, from the Circumference to the Center of the *Bud*; as in the *Hasel*: For the Fibres of these Leaves standing out so far from a plain surface; they would, if not thus shelter'd, lie too much expos'd and naked to the Severities of the Weather. Where none of all the Protections above-named, are convenient, there the Membranes of

the Leaves by continuation in their first forming (together with some Fibres of the *Lignous Body*) are drawn out into so many *Mantles* or *Vails*; as in *Docks*, *Snakeweed*, &c. For the Leaves here being but few, yet each Leaf and its Stalk being both exceeding long, at the bottom whereof the next following Leaf still springs up, in the form and posture of all such as supersedes all the other kind of protection, and so each Leaf apart is provided with a *Vail* to itself.

The Uses of the Leaves, I mean in respect of their service to the Plant it self, are these; first, for Protection, which, besides what they give to one another, they afford also to the *Flower* and *Fruit*. To the *Flower* in their Foulds, that being, for the most part, born and usher'd into the open Ayr by the *Leaves*. To the *Fruit*, when afterwards

afterwards they are diſplay'd, as in *Strawberries*, *Grapes*, *Raſps*, *Mulberries*, &c. On which, and the like, ſhould the Sun-Beams immediately ſtrike, eſpecially while they are young, they would quite ſhrivel them up; but being by the Leaves ſcreened off, they impreſs the circumjacent Ayr ſo far only as gently to warm the ſaid Fruits, and ſo to promote their Fermentation and Growth. And accordingly we ſee, that the Leavs above-named are exceeding large in proportion to the *Fruits*: whereas in *Pear-trees*, *Apple-trees*, &c. the *Fruit* being of a ſolider *Parenchyma*, and ſo not needing the like protection, are uſually equal with, and often wider in Diameter than the *Leaves*.

Another uſe is for Augmentation; or, the capacity for the due ſpreading and ampliation of a Tree or Plant, are its Leaves: For herein

the *Lignous Body* being divided into ſmall Fibres, and theſe running all along their lax and ſpongie *Parenchyma*; they are thus a Body fit for the imbibition of *Sap* and eaſie growth. Now the *Sap* having a free reception into the Leaves, it ſtill gives way to the next ſucceeding in the *Branches* and *Trunk*, and the voyding of the *Sap* in theſe, for the mounting of that in the *Root*, and ingreſs of that in the Mould. But were there no Leaves to make a free reception of *Sap*, it muſt needs be ſtagnant in all the parts to the *Root*, and ſo the *Root* being clogg'd, its fermenting and other Offices will be voyded, and ſo the due growth of the whole. As in the motion of a Watch, although the original term thereof be the Spring, yet the capacity for its continuance in a due meaſure throughout all the Wheels, is the free and eaſie motion of the Balance.

Laſtly

Laſtly, As the Leaves ſubſerve
ne more copious advancement, ſo
ne higher purity of the *Sap*: For
is being well fermented both in
e Root, and in its Aſcent through
e *Trunk*, and ſo its Parts pre-
ir'd to a farther ſeparation; the
roſſer ones are ſtill depoſited into
e Leaves; the more elaborate
d eſſential only thus ſupplied
the *Flower*, *Fruit* and *Seed*, as
eir convenient Aliment. Whence
is, that where the *Flowers* are
any and large, into which the
ore odorous Particles are copi-
ſly receiv'd, the green Leaves
ve little or no ſmell; as thoſe
Roſe-tree, *Carnations*, *French-*
rigold, *Wood-bind*, *Tulips*; &c.
t on the contrary, where the
owers are none or ſmall, the
een Leaves themſelves are like-
ſe of a ſtrong ſavour; as thoſe
Wormwood, *Tanſie*, *Baum*, *Mint*,
e, *Geranium Moſchatum*, *Angeli-*
and others.

An

An Appendix.

Of Thorns, Hairs and Globulets.

THorns are of two kinds, *Li*
grous and *Cortical*. Of th
first are such as those of the *Haw*
thorn, and are constituted of al
the same substantial Parts whereo
the *Germen* it self, and in a lik
proportion: which also in thei
Infancy are set with the resem
blances of divers minute Leave
In affinity with these are the *Spi*
nets or *Thorny Prickles* upon th
Verges and Tops of divers Leave
as of *Barberry*, *Holly*, *Thistle*, *Furz*
and others; all which I think ar
th

he filamentous extremities of the *ignous Body* ſheathed in the *Skin*.

Cortical Thorns are ſuch as thoſe f the *Rasberry* Buſh, being not, nleſs in a moſt extraordinary ſmall roportion propagated from the *ignous Body*, but almoſt wholly om the *Cortical* and *Skin*, or from e *Barque*.

The growth of this *Thorn* may ther argue what in the Second hapter we ſuppoſed; *ſc.* That the proper tendency of the *Li-ous Body*, is to aſcend, ſo of the *rtical* to deſcend. For as the *gnous Thorn*, like other Parts on the *Trunk*, in its growth aſ-nds; this being almoſt wholly *rtical*, pointeth downward. The of *Thorns* the very Ingenious . *Sharrock* hath obſerved.

Upon the Leaves of divers nts two Productions ſhew them-res, *ſc. Hairs* and *Globulets*. Of *rs*, only one kind is taken no-

tice

tice of, although they are various. Ordinarily they are plain; which when fine and thick set, as on most *Hairy Buds*; or fine and long, as on those of the *Vine*, we call them *Down*.

But sometimes they are not plain, but branched out, from the bottom to the top, reciprocally on every side, in some resemblance to a *Stags-Horn*; as in *Mullen*. And sometimes they are *Astral*, as upon *Lavender*, and some other Leaves and especially those of *Wild Olive*, wherein every *Hair* rising in one round entire Basis a little way above the Surface of the Leaf, then disparted, Star-like, into several, four, five or six points, all standing at right Angles with the said perpendicular Basis.

The Uses of Hairs are for Distinction and Protection. That Distinction is but secondary, the Leaves being grown to a consid-

rable
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ore plai
ricus.
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but fri
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d conf
ots, ob

able ſize. That of Protection is he prime, for which they were o-iginally form'd together with the Leaves themſelves, and whoſe ſer-vice they enjoy in their Infant-ſtate: For the *Hairs* being then n form of a *Down*, alwayes very hick ſet, thus give that protection o the Leaves, which their exceed-ng tenderneſs then requires; ſo hat they ſeem to be veſted with a Coat of *Frieze*, or to be kept warm, ike young and dainty Chickens, n Wooll.

Globulets are ſeen upon *Orach*, oth Garden and wild; and yet nore plainly on *Mercury* or *Bonus Henricus*. In theſe, growing al-noſt upon the whole Plant, and eing very large, they are by all aken notice of.

But ſtrict Obſervation diſcovers, hat theſe *Globulets* are the natural nd conſtant Off-ſpring of very nany other Plants. Both theſe

Globulets

Globulets, and likewise the diversity of *Hairs*, I find the Learned Mr. *Hook* hath already observed. They are of two kinds; *Transparent*, as upon the Leaves of *Hysop*, *Mint*, *Baume*, and many more: *White*, as upon those of *Germander*, *Sage*, and others. All which, though the naked Eye will discover, yet by the help of Glasses we may observe most distinctly. The use of these we suppose the same with those of the *Flower*, whereof we shall speak.

CHAP.

CHAP. V.

Of the Flower.

WE next proceed to the *Flower*. The general Parts whereof are most commonly three; *sc.* the *Empalement*, the *Foliation*, and the *Attire*.

The *Empalement*, whether of one or more pieces, I call that which is the utmost part of the *Flower*, encompassing the other two. 'Tis compounded of the three general Parts, the *Skin*, the *Cortical* and *Lignous Bodies*; each *Empaler* (where there are divers) being as another little Leaf; as in those of the *Quince-Flower*, as oft as they happen to be overgrown, is well seen.

As likewiſe in the *Primroſe*, with the green Flower, commonly ſo call'd, though by a miſtake; for that which ſeems to be the *Flower*, is only the more flouriſhing *Empalement*, the *Flower* it ſelf being white; but the continuation of all the three aforeſaid Parts into each *Empaler*, is diſcoverable, I think, no where better than in an *Artichoke*, which is a true *Flower*, and whoſe *Empalers* are of that amplitude, as fairly to ſhew them all: As alſo, that the Original of the *Skin* of each *Empaler* is not diſtinct from that of the reſt; but to be all one piece, laid in ſo many Plaits or Duplicatures as there are *Empalers*, from the outermoſt to the inner and moſt central ones.

The Deſign of the *Empalement* is to be ſecurity and Bands to the other two Parts of the *Flower*: To be their ſecurity before its opening, by intercepting all extremi-

tie

ties of Weather: Afterwards to be their Bands, and firmly to contain all their Parts in their due and most decorous posture; so that a *Flower* without its *Empalement*, would hang as uncouth and raudry as a *Lady* without her *Bodies*.

Hence we have the reason why it is various, and sometimes wanting. Some *Flowers* have none, as *Tulips*; for having a fat and firm Leaf, and each Leaf likewise standing on a broad and strong Basis, they are thus sufficient to themselves. *Carnations*, on the contrary, have not only an *Empalement*, but that (for more firmitude) of one piece: For otherwise, the foot of each Leaf being very long and slender, most of them would be apt to break out of compass; yet is the top of the *Impalement* indented also; that the Indentments, by being lapp'd over the Leaves before their expansion, may then

protect them; and by being ſpred under them afterwards, may better ſhoulder and prop them up. And if the feet of the Leaves be both long and very tender too, here the *Empalement* is numerous, though conſiſting of ſeveral pieces; yet thoſe in divers Rounds, and all with a counterchangeable reſpect to each other (which alſo the Learned Dr. *Brown* obſerves) as in all *Knapweeds*, and other *Flowers*; whereby, how commodious they are for both the aforeſaid ends, may eaſily be conceiv'd; and well enough exemplified by the Scales of Fiſhes, whereunto, as to their poſition, they have not an unapt reſemblance.

The *Foliation* alſo, is of the ſame ſubſtantial nature with the green Leaf; the *Membrane*, *Pulp*, and *Fibres* whereof, being, as there, ſo here, but the continuation of the *Skin*, the *Cortical* and *Lignous Bodies*. The

The Foulds of the *Flower* or *Foliation* are various, as thoſe of the green Leaf; but ſome of them different. The moſt general are, Firſt, The *Plain Couch*, as in *Roſes*, and many other double *Flowers*. then the *Concave Couch*, as in *Blattaria flore albo*. Next the *Plait*, as in ſome of the Leaves of *Peaſe-Blooms*, in the Flowers of *Coriander*, &c. which is either ſingle, as in thoſe nam'd; or double, as in *Blew-Bottle*, *Jacea*, and more of that rank. Next, the *Couch* and *Plait* together in the ſame Flower, as in *Marigolds*, *Daiſies*, and all others of an agreeing form: where the firſt apparent Fould or Compoſture of the Leaves is in *Couch*; but the Leaves being erect, each likewiſe may be ſeen to lie in a double *Plait* within it ſelf. Then the *Rowl*, as in the *Flowers* of *Ladies-Bower*, the broad top of each Leaf being by a double *Rowl* foulded up in-

wardly. Next, the *Spire*, which it the beginning of a *Rowl*; and may be ſeen in the Flowers of *Mallows*, and others. Laſtly, the *Plait* and *Spire* together, where the part analogous to the *Foliation*, is of one piece, the *Plaits* being here laid, and ſo carried on by Spiral Lines to the top of the *Flower*, as is in divers, and I think in *Convolvulus Doronici folio* more elegantly ſeen. The reaſon of all which varieties, a comparative conſideration of the ſeveral parts of the *Flower* may ſuggeſt. Ile only mention, that no *Flower* that I find, hath a *Back-Rowl*, as hath the green Leaf, for two Reaſons; becauſe its Leaves have not their Fibres ſtanding out much on their backſide, as the green Leaves have; and becauſe of its Attire, which it ever emboſomes, and cannot ſo well do it by a *Back-Rowl*.

The uſual Protections of *Flowers*

ers by the Precedents are expreſs'd, *c. Green Leaves* and *Empalements*. Some have another more peculiar, that is a *double Vail*; as the *Spring-Crocus*. For having no *Empalement*, and ſtarting up early out of the Mould, even before its *Green Leaves*, and that upon the firſt opening of the Spring; leſt it ſhould thus be quite ſtarved, 'tis born ſwath'd up in a double Blanket, or with a pair of Sheets upon its Back.

The Leaves of divers *Flowers* at their Baſis have an *hairy Tuft*; by which *Tufts* the Concave of the *Empalement* is fill'd up; that, being very choice and tender, they may thus be kept in a gentle and conſtant warmth, as moſt convenient for them.

The Leaves of the *Flower*, though they are not hairy all over, yet in ſome particular parts they are often ſet with a fine Downy Velvet;

that, being by their ſhape and poſture in thoſe parts contiguous to their delicate and tender Attire, they may thus give it a more ſoftly and warmer touch. Thus in the Flower of *Ladies Bower*, thoſe parts of its Leaves which rowl inward, and lie contiguous to the Attire, are Downy; whereas the other parts are plain and ſmooth: So the Flowers of *Peaſe*, *Spaniſh Broom*, *Toad-Flax*, and many others, where contiguous to their Attires, are deck'd with the like *Hairy Velvet*.

As upon the Green Leaves, ſo upon the Flowers are *Globulets* ſometimes ſeen; as upon the backſide of that of *Enula*. On none more plainly than that kind of *Blattaria* with the white Flower; where they are all tranſparent, and growing both on the Stalk and Leaves of the *Flower*, each ſhewing likewiſe its *Peduncle* whereon it is erected.

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The uſe of the *Flower*, or the *Foliation* whereof we now ſpeak, (that is, as to its private ſervice) is for the protection of the Attire; this, as its under, and the *Empalement* as its upper Garments; as likewiſe of the *Fruit*: The neceſſity of which Service, in ſome Caſes, by the different ſituation of the *Flower* and *Fruit*, with reſpect to each other, is evident; *Apples*, *Pears*, and ſeveral other *Fruits*, ſtanding behind or under the *Flower*; but *Cherries*, *Apricots*, and divers others, within it; for theſe, being of a very tender and pulpous Body, and withal putting forth with the colder part of the Spring, could not weather it out againſt the Variations and Extremities of the Air, (as thoſe of a more ſolid *Parenchyma* can) except lodged up within their *Flowers*.

And as the *Flower* is ſerviceable to the ſafety of the *Fruit*, ſo is it

to

to its growth; *ſc.* in its Infancy, or *Embryo*-eſtate; for which purpoſe, as there is a Flower, ſo that Flower is greater or leſs, according as the nature of the Fruit to which it belongs, and the plenty of the *Sap* by which the Fruit is fed, doth require. Thus, where the young Fruit is of a ſolider conſtitution, and the aſcent of the *Sap* leſs copious, were there here no *Flower* to promote the ſaid aſcent thereof into the Fruit (in the manner as is effected by the Green Leaves) it muſt needs pine and die, or prove leſs kindly. On the contrary, ſhould the Flower be over-large, it would not only promote the aſcent of the *Sap* up to the Fruit, but being as yet over-proportionate to it, would likewiſe it ſelf exhauſt the ſame *Sap*, as faſt as aſcendent; like a greedy Nurſe, that prepares the Meat for her Child, and then eats it up her ſelf. Thus we ſee

Apples

Apples and *Pears* with a *Flower* of a moderate size, like their Body; of a middle Constitution, and their *Sap* of a middle quantity: But *Quinces*, being more solid, besides that they have as great a *Flower*, the *Impalers* of their *Flower* also arrive so far as to become handsom leaves, continuing also after the *Flower* is fallen, firm and verdent a great while; so long till the *fruit* be able to provide for it self. On the other hand, *Plums* being more tender and Sappy than *Apples* and *Pears*, besides that their *Empalers* are much alike, their *flower* is less. And *Gooseberries* and *Currans*, which are still more Pulpy, and the course of the *Sap* towards them more free, have yet a *flower* far less. And *Grapes*, whose *Sap* is still of quick-er Ascent, have scarce any *flower* at all; only some small resemblance thereof, serving just upon the setting of the *fruit*, and no longer.

The

The *Attire* I find to be of two kinds, *Seminie* and *Florie*: That which I call *Seminie*, is made up of two general parts, *Chives* and *Semets*, one upon each *Chive*. These *Semets* have the appearance (especially in many *flowers*) of so many little *Seeds*; but are quite another kind of Body: For upon enquiry we find, that these *Semets*, though they seem to be solid, and for some time after their first formation, are entire; yet are they really hollow; and their side, or sides which were at first entire, at length crack asunder: And that moreover the Concave of each *Semet* is not a meer vacuity, but fill'd up with a number of minute Particles in form of a Powder; which though common to all *Semets*, yet in some, and particularly those of a *Tulip*, being larger, is more distinctly observable.

These *Semets* are sometimes fast-

nec

ed ſo, as to ſtand erect above
heir *Chive*, as thoſe of *Larks-heel.*
ometimes, and I think uſually, ſo
; to hang a little down, in the
anner and figure of a *Kidney*;
; in *Mallows.* Their Cleft or Crack
ſometimes ſingle, but for the
oſt part double: At theſe Clefts
is that they diſburſe their Pow-
ers; which as they ſtart out, and
and betwixt the two Lips of each
left, have ſome reſemblance to
e common Sculpture of a *Pome-*
anate with its Seeds looking out
the Clefts of its *Rind*: This
uſt be obſerv'd when the Clefts
e recently made, which uſually
before the expanſion of the
ower.

The Particles of theſe Powders,
ough like thoſe of Meal or other
uſt, they appear not eaſily to
ve any regular ſhape; yet upon
ict obſervation, eſpecially with
e aſſiſtance of an indifferent
Glaſs,

Glaſs, it doth appear, that they are nothing elſe but a *Congeries* of ſo many perfect *Globes* or *Globulets*: That which obſcures them: is their being ſo ſmall. In *Dogs-Mercury*, *Borage*, and very many more Plants, they are extreamly ſo In *Mallows*, and ſome others, mor fairly viſible.

Some of theſe Powders are yel low, as in *Dogs-Mercury*, *Goats Rue*, &c. and ſome of other co lours: But moſt of them I thinl are white; and thoſe of yellov *Henbane* very elegant; the dis burs'd Powders whereof, to the na ked eye, are white as Snow; bu each *Globulet*, through a Glaſ tranſparent as Cryſtal; which not a fallacy from the Glaſs, bu what we ſee in all tranſparent Bo dies whatſoever, lying in a Pow der or ſmall Particles tog ther.

The *Florid Attire*, is commo

y known by the blind and rude Name of *Thrums*; as in the Flowers of *Marigold*, *Tansie*, &c. How dequate its imposition is, observation will determine: For the everal *Thrums* or rather *Suits*, hereof the *Attire* is made up, however else they may differ in arious Flowers, in this agree, hat they are never consistent of ore than one, sometimes of two, nd for the most part of three eces (for which I call them *Suits*) nd each piece of a different, but greeable and comely form.

The *outer part* of every *Suit*, is *Floret*: whose *Body* or *Tube* is vided at the top (like that of e *Cowslip*) into divers distinct aves; so that a *Floret* is the Epime of a *flower*; and is all the *wer* that many Plants, as *Mugrt*, *Tansie*, and others, have. hat the Learned Dr. *Brown* obveth of the number Five as to

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the Leaves of the *flower*, is still more universally holding in these of the *Floret*.

Upon the Expansion of the *Floret*, the next part of the *Suit* is from within its *Tube* brought to sight; which we may (with respect to that within it) call the *Sheath*: For this also, like the *Floret*, is a concave Body; in its shape very well resembling the Fistulous Pouches of *Wake-Robin*, or of *Dragon*.

The *Sheath*, after some time dividing at the top, from within its Concave, the third and inner most part of the *Suit*, *&c.* the *Blade* advanceth and displayes it self. This part is not hollow, as the other two, but solid; yet at its point, not originally, but after some time, is evermore divided into two halves.

Upon the division of the said Point, there appears, as upon the

opening

opening of a *Semet*, a Powder of *Globulets*, which before lay enclo-ſed up within its Clefts; and are of the ſame nature with thoſe of a *Se-met*, though not ſo copious: So that all *flowers* have their *Powders* or *Globulets*. The whole *Attire* may in *Knapweed*, *Blewbottle*, &c. be obſerved.

The uſe of the *Attire*, how con-emptibly ſoever we may look up-on it, is certainly great. And though for our own uſe we value the Leaves of the *Flower*, not the *Foliation*, moſt; yet of all the three Parts, this in ſome reſpects is the choyceſt, as for whoſe ſake and Service the other two are made. The uſe hereof, as to Ornament and Diſtinction, is unqueſtiona-ble; but is not all. As for Di-ſtinction, though by the help of Glaſſes we may make it to extend far; yet in a paſſant view, which all we uſually make, we cannot

ſo well. As for Ornament, and particularly in reference to the *Semets*, we may ask, If for that meerly theſe were meant, then why ſhould they be ſo made as to break open, or to contain any thing within them? Since their Beauty would be as good as if they were not hollow, and is better before they crack and burſt open, than afterwards.

A farther uſe hereof therefore we muſt acknowledge, and may obſerve; and that is for food; for Ornament and Diſtinction to us, and for Food to other Animals. I will not ſay, but that it may ſerve even to theſe for Diſtinction too, that they may be able to know one Plant from another, and in their flight or progreſs ſettle where they like beſt; and that therefore the varieties of theſe ſmall parts are many, and well obſerved by them, which we take no notice of: Yet

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the finding out of Food is but in order to enjoy it: Which, that it is provided for a vast number of little Animals in the *attires* of all *Flowers*, observation perswades us to believe. For why else are they evermore here found? Go from one Flower to another, great and small, you shall meet with none untaken up with these Guests. In some, and particularly the *Sun-flower*, where the parts of the *Attire*, and the *animals* for which they provide, are larger, the matter is more visible. We must not think, that God Almighty hath left any of the whole Family of his Creatures unprovided for; but as the great Master, some where or other carveth out to all; and that for a great number of these little folk, He hath stored up their peculiar provisions in the *Attires* of *Flowers*; each *Flower* thus becoming their Lodging and their

Dining-Room, both in one.

Wherein the particular parts of the *Attire* may be more distinctly serviceable, this to one Animal and that to another, I cannot say Or to the same Animal, as a *Bee* whether this for the *Honey*, another for their *Bread*, a third for the *Wax*: Or whether all only suck from hence some *Juice*; or some may not also carry some of the Parts, as of the *Globulets* wholly away: Or lastly, what may be the primary and private use of the *attire* (for even this above said, though great, yet is but secondary) I now determine not

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CHAP. VI.

Of the Fruit.

THe general compoſition of all *Fruits* is one, that is, their *ſential* and truly *Vital Parts*, are all the ſame, and but the contiuation of thoſe which in the other arts of a *Vegetable*, we have aladyobſerved: Yet becauſe by e different Conſtitutions and nctures of theſe Parts, divers nſiderably different Fruits reſult; hall therefore take a particular ew of the more known and prinal of them, *ſc. Apples*, *Pears*, *ums*, *Nuts* and *Berries*.

An *Apple*, if cut traverſe, apars conſtituted of four diſtinct

Parts, the *Pill*, the *Parenchyma*, *Branchery* and *Coare*. The *Pill* is only the ſpreading and dilatation of the skin, or utmoſt part of the Barque in the Branch. The *Parenchyma*, when full ripe, is a tender delicate Meat: Yet as the *Pill* is but the continuation of the utmoſt part of the *Barque*; ſo is this but the continuance and ampliation, or (as I may call it) the ſwelth and ſuperbience of the *Inner part* thereof; which upon obſervation of a young and Infant *Apple* eſpecially, is evident. Thus we ſee the *Pith*, which is often tough, in many Roots, as *Parſnep*, *Turneps*, &c. is tender and edible. So here, the *Parenchyma*, though originally no more than the *Barque*, yet the plenty and purity of its *Sap* being likewiſe effectual to the fulneſs and fineneſs of its growth, it thus becomes a ſoft and tender meat. The *Branchery* is

nothing elſe but the Ramifications of the *Lignous Body* throughout all the parts of the *Parenchyma*; the greater Branches being likewiſe by the *Inoſculations* of the leſs (as in the Leaf) united together. The main Branches are uſually fifteen; ten are ſpred and diſtributed through the *Parenchyma*, all enarching themſelves towards the *Cork* or *Stool* of the *Flower*; the other five running from the *Stalk* in a directer Line, at laſt meet the former at the ſaid *Cork*, and are there oſculated with them. Theſe five are originated from one; which running along the Center of the *Stalk*, and part of the *Parenchyma* of the *Fruit*, is therein at laſt divided. To theſe the Coats of the *Kernels* are faſtned; ſo that whereas theſe Branches were originally all extended even beyond the *Fruit*, and inſerted into the *Flower* for the due growth thereof;

the *Fruit* afterwards growing to ſome head, and ſo intercepting and preying upon the Aliment of the *Flower*, ſtarves that, and therefrom ſuperſedes the ſervice of the ſaid Branches to it ſelf, ten for its *Parenchyma*, and five for its *Seed*. The *Coar* is originated from the *Pith*; for the *Sap* finding room enough in the *Parenchyma*, through which to diſpence it ſelf all abroad, quits the *Pith*, which thereby hardens into a *Coar*. Thus we ſee the *Inſertions*, although originate from the *Cortical Body*, yet their Parts being, by the *Inoſculations* of the *Lignous*, ſo much compreſs'd and made to co-incide together, they become a Body very compact and denſe. And in the *Barque* we ſee the ſame effect by *arefaction* only, or a meer *voydance* of the *Sap*; the *Inner Part* whereof, though ſoft and ſappy, yet its ſuperficial *Rind* is often ſo hard and ſmooth, that

that it may be fairly writ upon.

In a *Pear* there are five distinct Parts, the *Pill*, the *Parenchyma*, *Branchery*, *Calculary* and *Acetary*. The three former are here and in an *Apple* much alike; saving that here the *Inner* or *Seed-Branches* are ordinarily ten. The *Calculary* (most observable in rough-tasted, or *Choak-Pears*) is a *congeries* of little stony Knots: They are many of them dispersed throughout the whole *Parenchyma*; but lying more continuous and compact together towards the Center of the *Pear*, surround the *Acetary* there in a somewhat Globular Form. About the *Stalk* they stand more distant; but towards the *Cork* or *Stool* of the *Flower*, they still grow closer, and there at last gather (almost) into the firmitude of a *Plum-stone* it self. Within this lies the *Acetary*: 'tis of a soure taste, and by the bounding of the *Calculary*

of

of a *Globular Figure*. 'Tis a ſimple Body, having neither any of the *Lignous* branched in it, nor any Knots. It is of the ſame ſubſtantial nature with the *Parenchyma*; but whether it be abſolutely one with it, or be derived immediately from the *Pith*, my Enquiries yet made, determine not.

The Original of the *Calculary* I ſeem to have neglected: But hereof we may here beſt ſay, that whereas all the other Parts are Eſſential and truly *Vital*, the *Calculary* is not; but that the ſeveral Knots whereof it conſiſts, are only ſo many meer Concretions or Precipitations out of the *Sap*; as in *Urines*, *Wines*, and other *Liquors*, we often ſee. And that this *Precipitation* is made by the mixture and re-action of the Tinctures of the *Lignous* and *Cortical Bodies* upon each other: Even as all *Vegetable Nutrition* or *Fixation*

of Parts is alſo made by the joynt efficiency of the two ſame Tinctures, as hath been ſaid. Hence we find, that as the *Acetary* hath no Branches of the *Lignous Body*, ſo neither hath it any Knots. Hence likewiſe it is, that we have ſo different and contrary a taſte in the *Parenchyma* beyond the *Calculary*, from that in the *Acetary*; for whereas this is ſoure, that, wherein the ſaid *Precipitations* are made, is ſweet; being much alike effect, to what we find in mixing of *Corals*, &c. with *Vinegar* or other *acid Liquors*.

In a *Plum* (to which the *Cherry*, *Apricot*, *Peach*, *Walnut*, &c. ought to be referr'd) there are four diſtinct Parts, the *Pill*, the *Parenchyma*, *Branchery* and *Stone*. The *Pill* and *Parenchyma* are, as to their Original, with thoſe of an *Apple* or *Pear* both alike: As likewiſe the *Branchery*; but differently

rently ramified. In *Plums* (I ſuppoſe all) there are five main *Out-Branches*, which run along the Surface of the *Stone* from the *Baſis* to the point thereof, four of them by the one Ridge. and one by the other oppoſite to it. In an *Apricot* there is the ſame number, but the ſingle Branch runs not upon the Surface, bnt through the Body of the *Stone*. There are likewiſe two or three ſmaller Branches, which run in like manner under the other Ridge for ſome ſpace, and then advancing into the *Parenchyma*, therein diſperſe themſelves: Theſe latter ſort in *Peaches* are numerous throughout: But notwithſtanding the different diſpoſition of the Branches of the *Fruits* aforeſaid; yet is there one Branch diſpos'd in one and the ſame manner in them all: The entrance hereof into the *Stone* is at its *Baſis*; from whence running through

its

its Body, and ſtill inclining or arching it ſelf towards its Concave, is at laſt about its Cone thereinto emergent, where the Coats of the *Seed* are appendent to it. Of the *Seed-Branch* 'tis therefore obſervable that after its entrance into the *Fruit*, 'tis alwaies prolonged therein to a conſiderable length; as is ſeen not only in *Apples*, &c. where the *Seed* ſtands a good diſtance from the *Stalk*; but in *Plums* likewiſe, where it ſtands very near it; in that here the *Seed-Branch*, as is ſaid, never ſtrikes through the *Stone* into the Coats of the *Seed* directly, but about its Cone or remoter end. The *Stone*, though it ſeem a ſimple Body, yet it is compounded of different ones: The Inner Part thereof, as it is by far the thinneſt, ſo is it the moſt denſe, white, ſmooth and ſimple. The Original is from the *Pith*; difficult, but curious to obſerve: For the

Seed-

Seed-Branch, not ſtriking directly and immediately quite through the *Baſis* of the *Stone*, but in the manner as is above deſcribed, carries a conſiderable part of the *Pith*, now gather'd round about it, as its *Parenchyma*, along with it ſelf; which, upon its entrance into the concave of the *Stone* about its farther end, is there in part ſpred all over it, as the Lining thereof. The outer and very much thicker Part conſiſteth partly of the like *Precipitations* or concrete Particles, as in a *Pear*, being gathered here much more cloſely, not only to a Contiguity, but a coalition into one entire Stone; as we ſee in *Pears* themſelves, eſpecially towards the *Cork*, they gather into the like Stoninefs; or as we ſee a *Stone*, *Mineral* or *Animal*, oftentimes the product of accumulated *Gravel*: But as the *Parenchyma* is mixed with the Concretion in the *Calcu-*

lary,

lary, so is it also, though not visibly, with these in the *Stone*, the ground of the *Stone* being indeed a perfect *Parenchyma*; but by the said Concretions so far alter'd, as to become dry, hard and undistinguishable from them.

In a *Nut* (to which an *Akern* is analogous) there are three general Parts, the *Cap*, *Shell* and *Pith*. The *Cap* is constituted of a *Pill* and *Parenchyma* derived from the *Barque*, and *Ramulets* from the *Ligneous Body* of the *Branch*. The *Shell* likewise is not one simple Body, but compounded. The superficial Part thereof is originated from the *Pill* or *Skin* of the *Cap*, from the inside whereof it is in a Duplicature produc'd and spread over the *shell*: which, if you look at the *Basis* of the *shell*, is farther evident; for that being continuous with the *Parenchyma* of the *Cap*, without the interposure

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of the *Skin*, the ſaid ſuperficial Part is there wanting. The thicker and inner part of the *ſhell* conſiſteth of the ſame *Parenchyma* as that of the *Cap*, with a *congeries* of *Precipitations* filled up, as in a Stone. And as the *Lignous Body* is branched in a Stone, ſo, with ſome difference, in a Shell. The *Outer Branches* or *Ramulets* are numerous, each iſſuing out of the *Parenchyma* of the *cap*, and entring the *Shell* at the Circumference of its *Baſis*, and ſo running betwixt its ſuperficial and inner parts towards its *cone*, in a Round. The *Inner* or *Seed-Branch* is ſingle, entering in, as do the other, ~~not~~ at the *Baſis* of the *Shell*, but at the *center* thereof; from whence it runs not through the *Shell*, as in *Plum* through the *Stone*; but through the *Pith*, as far as the *cone*, where the Coats of the *Seed* hang appendent to it. The *Pith*, whether

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derived from the ſame part both in name and nature in the *Branch* and *Stalk*, or from the *Cortical Body*, I yet determine not.

A *Berry*, as a *Gooſeberry* (to which *Currans*, *Grapes*, *Hipps*, &c. are to be referr'd), conſiſteth, beſides the *Seed*, of the three general Parts, *Pill*, *Parenchyma* and *Branchery*: The *Pill* is originated as in the foregoing Fruits. The *Parenchyma* is double, as likewiſe in ſome other *Berries*: The *outer* is commonly, together with the *Pill*, call'd the *Skin*, and is that part we ſpit out, being of a ſoure taſte. As the *Pill* is originated from the *outer*, ſo this from the *inner part* of the *Barque*; and accordingly the Pores thereof may be obſerved plainly of a like ſhape with thoſe both of the *Cortical Body* and *Pith*. The *inner* is of a ſweet taſte, and is the part we eat: It is of a conſtitution ſo laxe and ten-

der, as it would ſeem to be only a thicker or jellied Juice; although this likewiſe be a true *Parenchyma*, ſomething like that of an *Orange* or *Limon*, with its Pores all fill'd up with Liquor. The *Branchery* is likewiſe double: The *Exterior* runs betwixt the *Pill* and outer *Parenchyma* in arched Lines, from the *Stalk* to the *Stool* of the *Flower*. Theſe outer Branches, though of various number at the *Stalk*, yet at the *Cork* are uſually ten principal ones; five for the five Leaves of the *Flower*, and five for the *Chives*. The inner main Branches are two, diametrically oppoſite to each other, and at the *Cork* with the other inoſculated. From theſe two are branched other ſmaller, every one having a *Seed* appendent to it, whoſe Coats it entreth by a double Filament, one at the *Baſis*, the other at the *Cone*. They are all very white and turgent

gent, and by a flaunt cut, may be obſerv'd concave; thus repreſenting themſelves analogous to ſo many true *ſpermatick Veſſels.*

The Uſes of *Fruits* are for *Man*, (ſometimes alſo other *Animals*, as are *Akerns* and *Haws*) and for the *Seed.* For Man, they are ſo variouſly deſirable, that till our Orchards and Store-Chambers, *Confectioners* Stores and *Apothecaries* Shops, our Ladies Cloſets, their Tables or Hands are empty of them, I ſhall not need to enquire for what. If it be asked, how the Fruit becomes, generally above all the other Parts, ſo pleaſant a Meat? It is partly from the *Sap*, the groſſer portion thereof being depoſited in the Leaves, and the purer hereunto reſerved; partly from the Globular Figure of the Fruit; for the *Sap* being thus in a greater quantity herein, and in all parts equally diffus'd, the Con-

coction hereof is with greateſt advantage favoured and promoted. Wherefore all Fruits which we eat raw, how ſmall ſoever, are of a Globular form, or thereunto approaching; and the nearer, the delicater; amongſt *apples*, the *Pippin*; amongſt *Pears*, the *Burgundian*; and amongſt all Fruits, the *Grape*; and amongſt *Grapes*, the roundeſt, are of all the moſt dainty.

The viſible cauſe of this Globular Figure, is the *Flower*; or the Inoſculation of all the main Branches at the *Stool* of the *Flower*, and upon the fall of the *Flower* the obtuſeneſs, and with Wind and Sun, as it were the ſearing of the ſeveral ends: For thus the *Sap* ſetting the *Fruit*, being not able to effect, either a Diſunion, or ſhooting forth of the ſaid Branches, and ſo to carry on their growth in length; they muſt thus of neceſſity

be enarch'd, and with the *Parenchyma* more and more expand themſelves. Whereas were they diſpos'd and qualified otherwiſe, than as is ſaid, inſtead of forming a Fruit within bounds, they would run out into all extravagance, and even into another little Tree or Leafy growth.

To the *Seed*, the *Fruit* is ſerviceable; Firſt, in order to its being ſupply'd with a due and moſt convenient *Sap*, the greater and leſs elaborated part thereof being, in its paſſage towards the *Seed*, thereinto received; the *Fruit* doing the ſame office to the *Seed*, which the *Leaves* do to the *Fruit*; the *Sap* in the *Fruit* being in a laxe compariſon, as the *Wine*; and that for the *Seed*, a ſmall part of the highſt Spirit rectified from it.

So likewiſe for its Protection, in order to the proſperous carrying on and perfecting of its generati-

on, and ſecurity being perfected. Which protection it gives not only to the Seminal *Sap* and *Seed* it ſelf, but alwaies alſo to its *Seed-Branch*. Thus we ſee an *Apple*, beſides that it is it ſelf of ample compaſs, for the ſake of its *Seed*, hath likewiſe its *coar*; as if it were not ſufficient, that the Walls of their Room are ſo very thick, unleſs alſo wainſcotted. In a *Pear* again, where the *Parenchyma* is of leſs compaſs than that of an *Apple*, to what protection this affords, that of the *Calculary* is ſuper-added. But in a *Plum*, where the *Parenchyma* is exceeding tender, and in a *Peach*, which hangs late, and till Autumn Froſts approach, we have not only the Rubbiſh of a *Calculary*, but ſtout Stone-Walls. Within which alſo, not only the *Seed* it ſelf, but the *Seed-Branch* is ever more immur'd. Laſtly, in a *Nut* where the *ſhell* being not ſurrounded

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ed with a *Parenchyma*, that protection is wanting without, 'tis anſwer'd by an ample *Pith* within it; and the *ſeed-Branch* likewiſe included, not meerly in the Body of the Shell, as in a *Plum*, but within the *pith* it ſelf. So neceſſary is this deſign, that what the Hen by Incubation or Hovering, is to the Egg or Chick; that the whole *Fruit*, by comprehenſion, is to the *Seed*.

CHAP. VII.

Of the Seed.

AS the Original, ſo the Ultimate end & Perfection of *Vegetation* is the *Seed*. How it is the former, and in its ſtate apt for *Vegetation*, hath already been ſeen. How the latter, and in its ſtate of Generation, we ſhall now laſtly enquire. In doing which, what in the other ſtate was either not diſtinctly exiſtent, or not ſo apparent, or not ſo intelligible, will occur.

The two general Parts of the *Seed* are its *Covers* and *Body*. The *Covers* in this eſtate are uſually four;

four; the outmoſt we may call the *Caſe*: 'Tis of a very various form; ſometimes a *Pouch*, as in *Naſturtium*, *Cochlearia*; a *Cod*, as in all *Pulſe*, *Galega*; ſometimes not entire, but parted, or otherwiſe open, as in *Sorrel*, *Knotgraſs*, with many other forms; I think alwaies more heterogeneous to that of the *Seed*, by which it differs from the proper Coats. To this the Caps of *Nuts*, and the *Parenchyma's* of Fruits are analogous.

The two next are properly the Coats: In a *Bean* eſpecially, and the like; from whence to avoyd Confuſion, the denomination may run common to the reſponding Covers of other *Seeds*. The Colour of the outer is of all degrees, from White to the Blackneſs of *Jett*: Its Figure ſometimes Kidney'd, as in *Alcea*, *Behen*, *Poppy*; triangular, as in *Polygonatum*, *Sorrel*; triangular ſpherical, in *Mentha*,

tha, *Melissa*; circular, in *Leucoium*, *Amaranthus*; globular, in *Napus*, *Asperula*; oval, in *Speculum Veneris*, *Tithymalus*; half Globe, in *Coriander*; that which we take for one single round *Seed*, being a Conjugation of two; half Oval, in *Anise*, *Fennel*; Hastal, in *Lactuca*; Cylindrical, as, if I mistake not, in *Jacobæa*; Pyramidal, in *Geranium*, *Althææ Fol.* with many other differences: But the Perfection of one or two of the said Figures lieth in the *Case*: So that as all Lines and Proportions are in the *Flower*, so all Regular Figures in the *Seed*, or rather in its *Covers*.

'Tis sometimes glistering, as in *Speculum Veneris*; Rough-cast, in *Catanance*; Studded, in *Behen*, *Blattaria*; Tavous, in *Papaver*, *Antirrhinum*, *Lepidium annuum*, *Alcea Vesicaria*, *Hyosciamus*, and many more, before the *Seeds* have lain

lain long by; Pounced, in *Phalangium Cretæ*, *Lithospermum*; Ramified, in *Pentaphyllum fragiferum*, *Erectum majus*, resembling the Fibres of the Ears of the Heart; some just *Quinquenerval*, as in *Anisum*, and many more, the *Ligneous Body* being in five main Fibres branched therein.

The Covers of not only *Quince*-Seeds, and those of *Psyllium* (more usually taken notice of) but those also of *Herminum*, *Nasturtium*, *Eruca*, *Camelina*, *Ocymum*, and divers others, have a *Mucilage*; which, though it be not visible when the Seeds are throughly dry; yet lying a while in some warm Liquor, or only on the Tongue, it swells more or less, and upon them all fairly shews it self. On that of *Ocymum* it appears grayish; on the other, transparent; and on that of *Nasturtium Hortense* very large; even emulous of the inner Pulp surrounding

rounding a *Gooſeberry-ſeed.* The putting of *Clary-ſeed* into the Eye, may have been brought into uſe from this *Mucilage*, by which alone it may become Medicinal. And thus far of the *Superficies.*

The nature of the outer Coat is various, *Membranous*, *Cartilaginous* and *Stony*; the like *Precipitations* being ſometimes made herein, as in a Stone or Shell; as in that of the Seeds of *Carthamum*, *Lithoſpermum*, and others. The Deſignment hereof, being either with reſpect to the *Seed* in its ſtate of Generation; as where the Caſe is either wanting, or at leaſt inſufficient of it ſelf, there for its due protection and warmth; or, in its ſtate of *Vegetation*, for the better Fermenting of its Tinctures and *Sap*; the Fermentations of ſome *Seeds* not well proceeding, unleſs they lie in their Stony Casks in the Mould, like Bottled Liquors in Sand. All

All *Seeds* have their outer Covers open; either by a particular *Foramen*, as in *Beans*, and other *Pulse*, as is said; or by the breaking off of the *Seed* from its *Peduncle* or *Stool*, as in those in *Cucumber*, *Cycory*; or by the entering and passage of a *Branch* or *Branches*, not only into the Concave thereof near the Cone, but also through the Cone it self; as in *Shells* and *Stones*.

For the sake of this *aperture* it is, that *Akerns*, *Nuts*, *Beans*, *Cucumbers*, and most other *Seeds*, are in their formation so placed, that the *Radicle* still standeth next to it; that, upon *Vegetation*, it may have a free and ready passage into the Mould.

The Original of the outer Coat, though from Parts of the same substantial nature, yet is differently made. In a *Plum*, the *Seed-Branch* which runs, as is described, through the

the Stone, is not naked, but, as is ſaid, inveſted with a thin *Parenchyma*, which it carries from the Stalk along with it; and which, by the *Ramification* of the ſaid *Branch* within the Stone, is in part dilated into a Coat. That of a *Bean* is from the *Parenchyma* of the Cod; the ſuperficial part of which *Parenchyma*, upon the large *peduncle* of the *Bean* becoming a thin Cuticle, and upon the *Bean* it ſelf a *cartilaginous* Coat.

The Original of the inner Coat of the *Bean* is likewiſe from the inner part of the ſaid *parenchyma*; which firſt is ſpred into a long Cake, or that which with the *ſeed-Branch* maketh the *peduncle* of the *Bean*; under which Cake, there is uſually a black part or ſpot; by the length of which, the inner part of the Cake is next inſerted into the outer Coat, and ſpred all over the Concave thereof.

This

This inner Coat, though when the *Seed* is grown old and dry, 'tis ſhrunk up, and in moſt Seeds ſo far as ſcarcely to be diſcern'd; yet in its firſt and juvenile Conſtitution, is a very Spongy and Sappy Body; and is then likewiſe (as the *Womb* in a pregnant Animal) in proportion very thick and bulky; in a *Bean*, even as one of the *Lobes* it ſelf: And in a *Plum* or *Apricot*, I think I may ſafely ſay, half an hundred times thicker than afterwards, when it is dried and ſhrunk up; and can ſcarcely be diſtinguiſhed from the upper Coat. Upon which Accounts it is, in this ſtate, a true and fair *Parenchyma*.

In this Inner Coat in a *Bean*, the *Lignous Body* or *Seed-Branch* is diſtributed: Sometimes, as in *French-Beans*, throughout the whole Coat; as it is in a Leaf: in the Great *Garden-Bean*, upon its

its first entrance, it is bipartite, and so in small Branches runs along the Circumference of the Coat, all meeting and making a kind of Reticulation against the Belly of the *Bean*. In the same manner the main Branches in the outer Coat of a *Kernel*, circling themselves on both hands from the place of their first entrance, at last meet, and mutually inosculate.

So that all the Parts of a *Vegetable*, the *Root*, *Trunk*, *Branch*, *Leaf*, *Flower*, *Fruit* and *Seed*, are still made up of two substantially different Bodies.

And as every Part hath two, so the whole *Vegetable* taken together, is a composition of two only, and no more: All properly Woody Parts, Strings and Fibres are one Body: All simple *Barques*, *Piths*, *Parenchyma's* and *Pulps*, and as to their substantial Nature, *Pills* and *Skins* likewise, all but one

Body

Body: the ſeveral Parts of a *Vegetable* all differing from each other, only by the various Proportions and Mixtures, and variouſly ſized Pores of theſe two Bodies.. What from theſe two general Obſervations might reaſonably be inferr'd, I ſhall not now mention.

The fourth and innermoſt Cover we may call the *Secondine*; the ſight whereof, by cutting off the Coats of an *Infant-Bean*, at the Cone thereof in very thin Slices, and with great Caution, may be obtain'd. While unbroken, 'tis tranſparent; being torn and taken off, it gathers up into the likeneſs of a Jelly, or that we call the *Trelle* of an Egg, when over-boyl'd. This *Membrane* in larger or elder *Beans*, is not to be found diſtinct; but becomes as it were the Lining of the inner Coat: But (as far as our Enquiries yet diſcover) it may in moſt other *Seeds*, even full grown, be

distinctly seen; as in those of *Cucumber*, *Colocynthis*, *Burdock*, *Carthamum*, *Gromwel*, *Endive*, *Mallows*, &c. 'Tis usually so very thin, as in the above-nam'd, as very difficultly to be discover'd. In some *Kernels*, as of *Apricots*, 'tis very thick; and in some other Seeds. That all these have the Analogy of one and the same Cover, which I call the *Secondine*, is most probably argu'd from their alike Natures; being all of them plain simple *Membranes*, with not the least Fibre of the *Lignous Body* or *Seed Branch*, visibly distributed in them; as also from their Contexture, which is in all of them more close.

The Concave of this *Membrane* is filled with a most transparent Liquor, out of which the Seed is formed; as in cutting a *petite* and *Infant-Bean*, may be seen; and yet better in a young *Walnut*. In

Bean

Beans I have obſerved it to turn, upon boyling, into a tender white *coagulum*.

Through this *Membrane*, the *Lignous Body* or *Seed-Branches* diſtributed in the inner Coat, at laſt ſhoot downright two ſlender Fibres, like two Navles, one into each *Lobe* of the *Bean*. The places where the ſaid Fibres ſhoot into the *Lobes*, are near the *Baſis* of the *Radicle*; and by their Blackiſhneſs well enough remark'd: but the Fibres themſelves are ſo very ſmall, as ſcarcely to be diſcern'd: Yet in a *Lupine*, of the larger kind, both the places where the Navel-Fibres ſhoot into the *Lobes* (which here from the *Baſis* of the *Radicle* is more remote), and the Fibres themſelves, are fairly viſible. For the *Seed-Branch*, upon its entrance into the Coat of the *Lupine*, is preſently divided into two *main Brauches*, and thoſe two into other leſs;

whereof ſome underly, others aloft, run along the Coat, and towards its other end meet and are inoſculated; where about two oppoſite, ſhallow, round, and moſt minute Cavities, anſwerable to two Specks of a *cartilaginous* gloſs, one in either *Lobe*, may be obſerved; which Specks are the ends of the ſaid *Navel-Fibres*, upon the ripening of the *Seed* there broken off. Theſe Fibres, from the Superficies of each *Lobe*, deſcend a little way directly down; preſently, each is divided into two Branches, one diſtributed into the *Lobes*, the other into the *Radicle* & *Plume*, in the manner as in the firſt Chapter is deſcrib'd. And thus far the Hiſtory. I ſhall now only with a brief account of the *Generation* of the *Seed*, as hereupon dependent, conclude this Diſcourſe.

Let

Let us ſay then, that the *Sap* having in the *Root*, *Trunk* and *Leaves*, paſſed divers Concoctions and Separations, in the manner as they are ſaid to be perform'd therein; 'tis now at laſt, in ſome good maturity, advanced towards the *Seed*.

The more copious and cruder part hereof is again ſeperated by a free reception into the *Fruit*, or other Part analogous to it: being either ſufficiently ample to contain it, or at leaſt laxe enough for its tranſpiration, and ſo its due diſcharge. The more Eſſential part is into the *Seed-Branch* or Branches entertain'd; which, becauſe they are evermore of a very conſiderable length, and of a Conſtitution very fine, the ſaid *Sap* thus becomes in its Current therein, as in the *Spermatick Veſſels*, ſtill more mature.

In this mature eſtate, from the *ſeed-Branch* into the Coats of the *ſeed*, as into the Womb, 'tis next delivered up. The meaner Part hereof again, to the outer, as *aliment* good enough, is ſupplied. The finer part is tranſmitted to the Inner; which, being, as is ſaid, a *Parenchymous* and more ſpatious Body, the *Sap* therefore is not herein, as in the outer, a meer *aliment*; but in order to its being, by Fermentation, farther prepared.

Yet the outer Coat, being on the contrary hard and denſe; for that reaſon, as it admitteth not the Fermentation of the *Sap* ſo well within it ſelf; ſo doth it the more promote and favour it in the Inner, being Bounds both to it and its *Sap*; and alſo quickneth the proceſs of the whole Work in the formation of the *Seed*.

Nor

Nor doth the outer Coat, for the ſame reaſon, more promote than declare the purity of the *Sap* now contained in the Inner: For being more hard and denſe, and ſo not perſpirable, muſt needs ſuppoſe the Parts of the *Sap* encompaſſed by it, ſince thus uncapable of any evacuation, to be therefore all, ſo choice, as not to need it.

The *Sap* being thus prepared in the inner Coat, as a Liquor now apt to be the *Subſtratum* of the future *Seed-Embrio*, by freſh ſupplies, is thence diſcharg'd; yet that it may not be over-copious; which, becauſe of the laxity of the Inner Coat from whence it iſſues, it might eaſily be; therefore as the ſaid inner Coat is bounded without by the upper Coat, ſo by the *Secondine* or *Membrane* is it bounded within; through which *Membrane*

the *Sap* being filtr'd, or, as it were, transpiring, the depositure hereof, answerable to the *Colliquamentum* in an Egg, or to the *semen Mulibre*, into its Concave at last is made.

The other Part of the purest *sap* embosom'd in the Ramulets of the *seed-Branch*, runs a Circle, or some progress therein; and so becomes, as the *Semen Masculinum*, yet more elaborate.

Wherein also, lest its Current should be too copious or precipitate, by their co-arcture and divarication where they are inosculated, it is retarded; the noblest portion only obtaining a pass.

With this purest *sap*, the said *Ramulets* being supplied, from thence at last, the *Navel-Fibres* shoot (as the privitive *Artery* into the

the *Colliquamentum*) through the *Secondine* into the aforesaid Liquor deposited therein.

Into which Liquor, being now shot, and its own proper Sap or Tinctures mixed therewith, it strikes it thus into a *Coagulum*; or, of a Liquor, it becomes a Body consistent and truly *Parenchymous*; and the supply of the said Liquor still continu'd, and the shooting of the Navel-Fibres, as is above described, still carried on, and ~~the~~ therewith the said *Coagulation* or *Fixation* likewise.

And in the Interim of the *Coagulation*, a gentle *Fermentation* being also made, the said *Parenchyma* or *Coagulum* becometh such, not of any Constitution indifferently, but is thus raised (as we see Bread in Baking) into

into a *Congeries* of *Fixed Bubbles*: For ſuch is the *Parenchyma* of the whole Seed.

FINIS.

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THE
EXPLICATION
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FIGURES.

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Fig. I.

Sheweth a Bean *with the two* Lobes *laid open ſomewhat wider than the Parts, without a Rupture, will well bear, for the better ſight of that Part which lieth between them.*

aaaa The two Lobes.
AA Their contiguous Flats.
b The Radicle.
c The Plume.
dd One of the Cavities wherein the Plume lieth.

Fig.

Fig. 2.

aaaa The *Parenchyma.*

eeee The *ſeminal Root* diſtributed throughout the *Parenchyma* of either *Lobe.*

b The *Radicle*, with the *ſeminal Root* running through it in one Trunk to the Point thereof.

c The *Plume*, with the Diſtributions of its *Inner Body* continued from the *ſeminal Root* of either *Lobe.*

xx The oblique *Inſertion* of the two grand Branches of the *Lobes* into the Trunk of the *Radicle.*

Fig.

Fig. 3.

The Lobe *of a* Bean *cut athwart.*

aaa The convex or external part thereof.

bbb The concave ſide out of ſight.

cccc The Extremities of the Branches of the *ſeminal Root*, as they appear like ſo many ſmall Specks in the traverſe Cut.

Fig. 4.

The Plume cut athwart.

The black Specks represent the Branches of the *seminal Body* thereinto inserted, or therein distributed.

Fig. 5.

aaaa A *Lobe* of a *Gourd-seed.*
cccc The greater Branches.
ee The Sub-divisions and Inoscula tions of the lesser.

Fig.

Fig. 5. 00.

AA A great white *Lupine.*

aa The *Navel-Fibres* which strike from the Ramulets of the *seed-Branch*, into the *Lobes.*

ab The production of the *Navel-Fibre* into the *Radicle* (*b.*)

c The *Plume.*

bc The *Pith.*

aeeee The distribution of the *Navel-Fibre* in the *Lobes*; all becoming the *seminal Root*, describ'd in the first Chapter.

Fig. 6.

aaaa A Slice of the Root of a Tree.

cccc The *Cortical Body* or *Barque.*

e The *Pith.*

The black Pieces are the Shootings of the *Lignous Body.*

The Specks therein are its *Pores.*

The White Pieces are the *Insertions* of the *Cortical Body.*

Fig.

Fig. 7.

Sheweth the Root of Berbery *in the Traverse Cut.*

aaa The *Cortical Body* or *Barque.*
The white Lines are the *Insertions.*
The Black Specks are the Pores of the *Lignous Body.*

Fig. 8.

aaaa The *Cortical Body* as appearing in a *Turnep* cut athwart.

acdacd The *Lignous Body*, or the ſeveral Shoots thereof repreſented in their Ranks, by the black Lines; the Pricks made along the Lines being the Terminations of the ſaid Shoots or Fibres; not viſible except in a thin ſlice, or after the Surface of the *Turnep*, being cut, is well dried.

cccc The *Cortical Body* inſerted betwixt the Shootings of the *Lignous*: or the *Pith*.

ab ab A piece of the *Cortical Body* taken off, that its own Inſertions (*eeee*) and the Oſculations of the *Lignous* may be ſeen; which is beſt done after the Inſertions are a little dried and ſhrunk.

Fig.

The Appearance of divers Roots, in their Elder estate, as ex. gr. *of a* Columbine.

Fig. 9.

the Fibrous parts of the *Root*, where the *Lignous Body* ſtands Central; the Pores whereof are repreſented by the black Specks.

10. The *Root* cut a little higher, where the *Cortical Body* ſometimes appears only once inſerted.

11. The *Root* cut higher with the Inſertions in ſome number.

12. The Inſertions ſtill more numerous.

13. The *Pith* (*a*) now begun, the ſaid Inſertions being collected in the Center.

14. The *Pith* (*a*) more amplified.

Fig. 15.

Sheweth a ſmall piece of the Trunk of Burdock.

a The juſt ſize thereof to the naked Eye.

aaaa The appearance of it through a *Microſcope.*

lll The Inſerted *Cortical Body.*

ccc The outmoſt ſhooting of the *Lignous Body* diſtributed into the Leaves.

ee bb t t The inner Shootingsor Fibres diſtributed to the Branches.

The Black Specks are their Pores, which, through a *Microſcope* are fairly viſible in them all.

Fig.

Fig. 16.

aaaa The Slice of a Trunk of divers years growth.

cccc The *The Cortical Body*, or *Barque.*

e The *Pith.*

The white Lines are the Insertions of the *Cortical Body* or *Barque.*

The Black Lines are the *lignous Body.*

The several Shootings thereof betwixt the black Circles shew the Annuall Rings.

Fig.

Fig. 17.

Sheweth a ſmall piece of Oak cut athwart.

b The juſt bigneſs of it, as it appeareth to the naked eye.

bbbb The appearance thereof through a *Microſcope*.

aaaa The greater Inſertions viſible to the bare eye.

The white Lines are the ſmaller Inſertions only viſible by the *Microſcope*.

cccccc The greater Pores viſible to the bare eye.

eeeeee The middle ſized.

The black Spots are the ſmalleſt of all, and both theſe latter viſible only through the *Microſcope*.

c The *Pith* of every great Pore.

Fig.

Fig. 18.

aaaa A piece of the Leaf of a Table.

bbbb The *lignous Body* with its Pores running by the length of the Trunk.

cccc The Insertions of the *Cortical Body*, with the Tract of their Pores running directly cross to those of the *lignous*, *viz.* by the Diameter or breadth of the Trunk.

Fig.

Fig. 19.

A Slice of a younger Trunk of a Burdock.

cccc The utmoſt Shootings of the *lignous Body* contiguous to the Skin; wholly diſtributed into the outer Leaves.

eeee The middle Shootings running chiefly into the lower *Germens.*

et et &c. The inner Shootings belonging to the higher *Germens.*

a The *Pith.*

Fig.

The various Disposure, Size and Figure of the Fibres *in the Stalk of a Leaf.*

Fig.

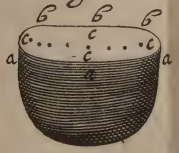
20 In *Endive* thus
21 *Coltsfoot.*
22 *Cycory.*
23 *Ivy.*
24 *Asarabacca.*
25 *Mint.*
26 *Dock.*
27 *Borage.*
28 *Mullen.*
29 *Cabbage.*

FINIS.

Fig: 19

Fig: 16

Fig: 3



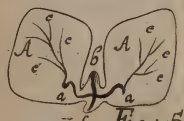
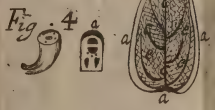


Fig: 5

Fig: 4



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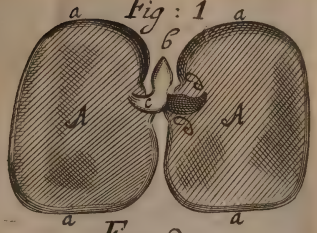

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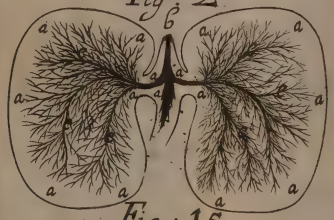
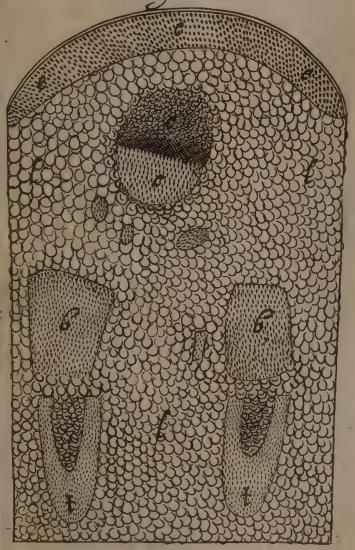


Fig: 15



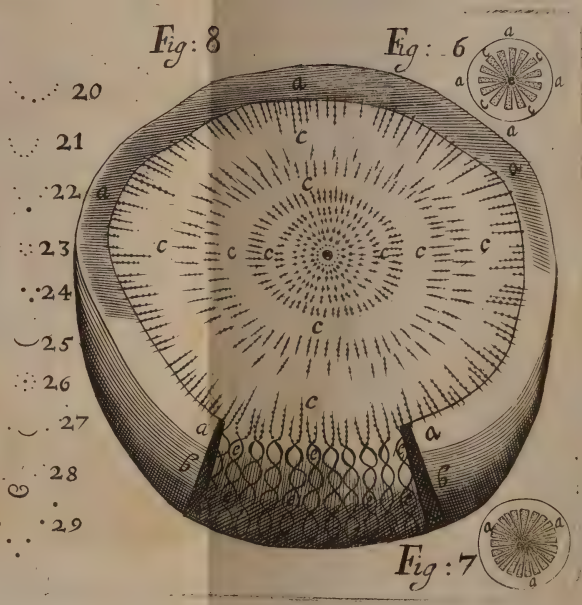


Fig: 8
Fig: 6
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Fig: 9 10 11 12 13 14

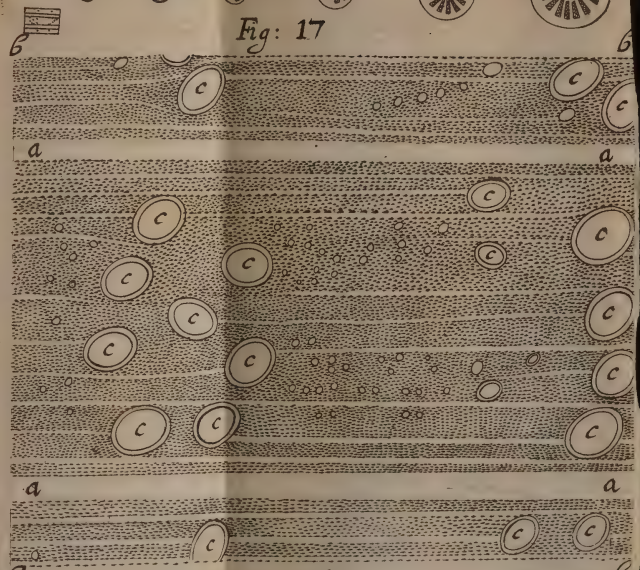

Fig: 17

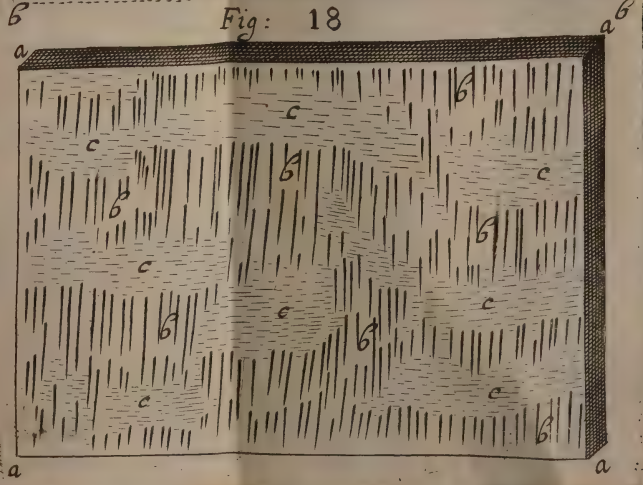

Fig: 18